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THE ABALONES OF NORTHERN CALIFORNIA.*

By Will F. Thompson.

In northern California there are found three species of abalone: namely, *Haliotis rufescens,* Swainson, the red; *H. cracherodii,* Leach, the black; and *H. wallalensis,* Stearns, the northern green abalone. Earnest search has failed to reveal the abalone of British Columbia and Alaska, *H. gigantea,* Chemnitz. But one of these, the first named, is found in numbers rendering it of importance as food. It is exceedingly difficult to gauge the absolute abundance of this red abalone in any place without the aid of diver's apparatus. For that reason it has been judged best to give merely a record of the localities in which specimens were obtained, and a general statement as to the abundance along the various parts of the coast. *H. cracherodii* reaches its greatest abundance to the southward of San Francisco, and it is present in northern California only occasionally.

*California State Fisheries Laboratory, Contribution No. 17.

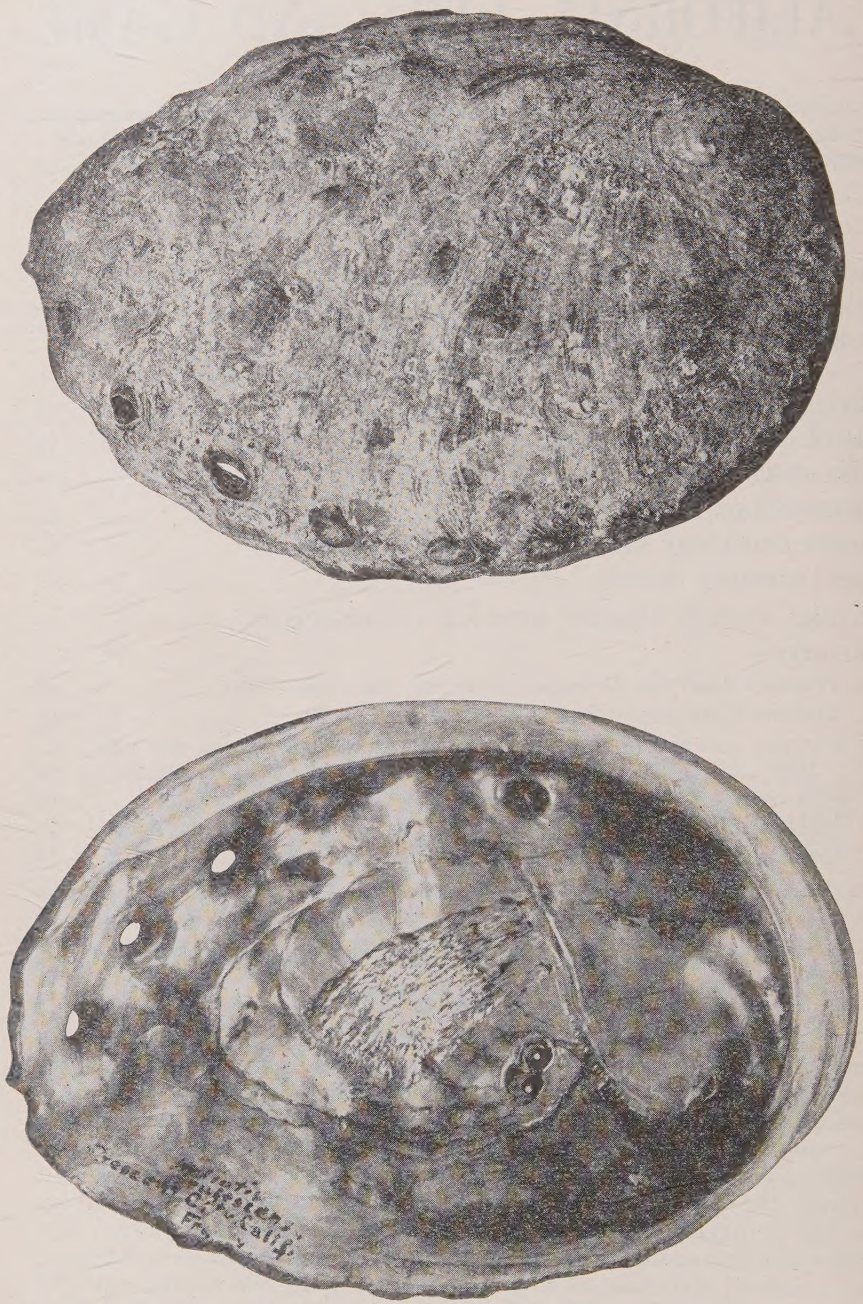

FIG. 16. Red abalone (*Haliotis rufescens* Swainson), from Crescent City, California Length 8½ inches.

Abalones dwell solely along the outer coasts, but there they dwell wherever they are afforded a foothold on or beneath rocks on a coast free from loose sand and mud. The red abalone is found below extreme low tide line and occasionally a little above, the black is at a higher level and rarely below low tide line, while the northern green abalone is found only at about low tide level as far as known. All species agree, however, in requiring a rocky, surf-beaten coast, and the localities given below are all of this nature.

Haliotis rufescens was found in some numbers in the following localities by others than the writer, if enclosed in parentheses:

(Point Saint George, rarely.)
Patrick's Point, rarely.
Cape Mendocino, rarely.
McNutt's Gulch, near Cape Mendocino.
Mattole River, 1 to 1½ miles north of Cape Mendocino.
(Punta Gorda.)
Spanish Flats, 124 degrees 15 minutes west, 40 degrees 20 minutes north.
(Fraser's Creek, near Cape Mendocino.)
Shelter Cove, abundant.
(Whale Gulch to Needle Rock.)
Bear Landing, in moderate abundance.
Usal, 123 degrees 50 minutes west, 40 degrees north.
(Rockport.)
Hardie's Creek.
(Union Landing.)
Abalone Point, 123 degrees 48 minutes west, 39 degrees 50 minutes north.
Bruhel's Point (McRay's Point).
(Kibesillah Rock.)
(Hare Creek and Beaver Point.)
(Caspar, 39 degrees 11 minutes north, 123 degrees 49 minutes west.)
(Newhaven Landing.)
(Manchester.)
Point Arena, abundant.
Arena Cove.
Buster Beach, 123 degrees 43 minutes west, 38 degrees 57 minutes north, abundant.
(Hayward's Beach.)
Saunders' Landing, 123 degrees 40 minutes west, 38 degrees 51 minutes north.
Bowen's Landing.
Gualala, 123 degrees 31 minutes west, 38 degrees 45 minutes north.
(Del Mar to Stewart's Point.)
Stewart's Point.
(Salt Point.)
(Fort Ross.)
Russian River.
(Bodega Head.)
(Tomales Point.)
Point Reyes, moderate abundance.
Duxbury Reef.
(Bolinas Point.)
(Double Point.)

From Point Saint George, the northernmost record, it was possible to obtain no live specimens, but Mr. Franz of Crescent City contributed a shell which he had kept for some time as an unusual specimen. At Patrick's Point live specimens were taken, and they were abundant enough so that eight or nine might be obtained by searching diligently throughout a low tide. Not until Cape Mendocino was reached were there sufficient numbers to render the species of importance, while at Shelter Cove, about forty miles southward, there was an abundance. From that locality to Point Reyes it might be considered that there was a slight increase in abundance when equally favorable situations were compared, and the effect of the relative amount of local use was considered. At Point Reyes, the abalone has been obtained by divers, with apparatus enabling them to go to considerable depths, and it is probable that such methods could be used as far north as Shelter Cove with success.

Haliotis cracherodii, the black abalone, reaches as far north as Point Arena, where an occasional specimen is found by local men. But one was obtained from that locality. They are also found at Duxbury Reef, and are reputed to be found now and then in the regions between Point Arena and San Francisco, but no actual evidence was obtained. In no locality in northern California do they reach any abundance,

FIG. 17. Black abalone (*Haliotis cracherodii* Leach), from Point Arena, California. Length 6¼ inches.

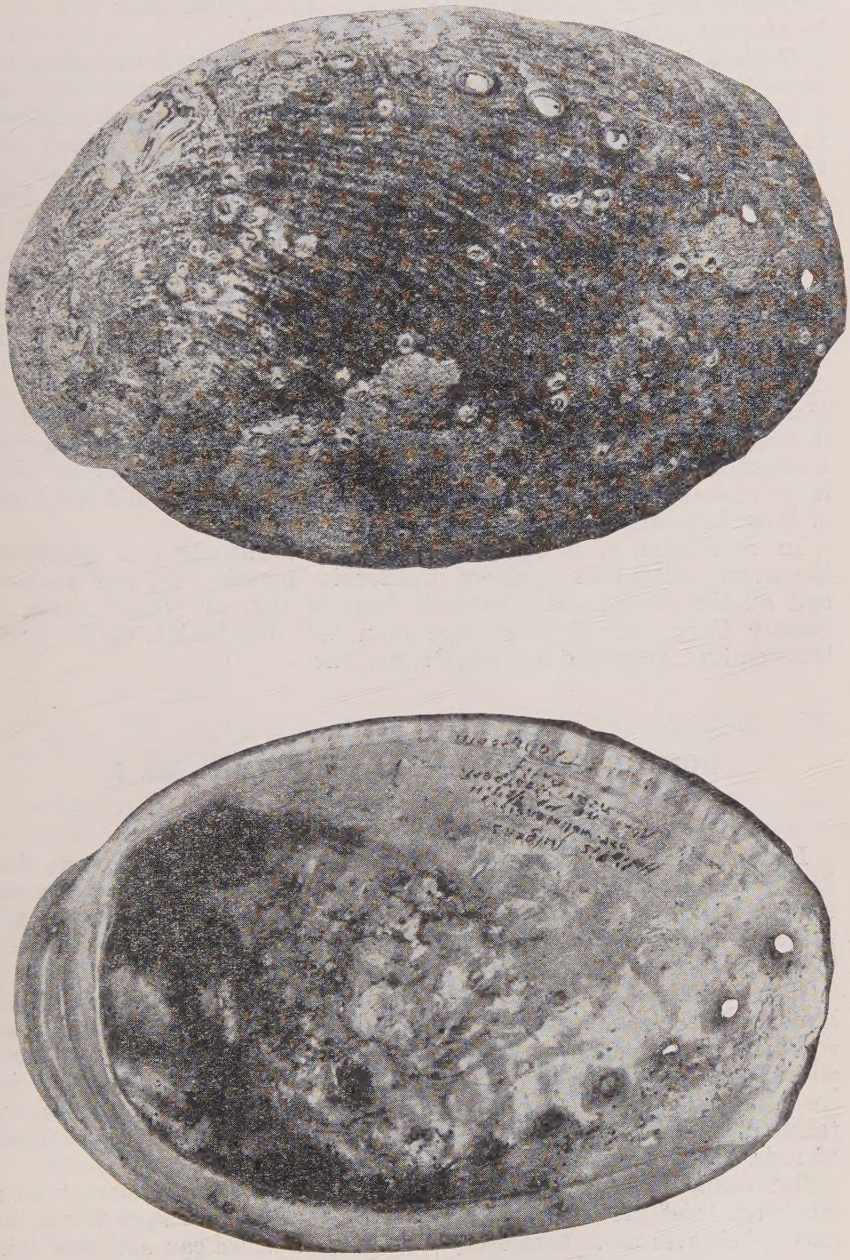

FIG. 18. Northern green abalone (*Haliotis wallalensis* Stearns), from Abalone Point near Westport, California. Length 4⅜ inches.

however, which would justify calling them anything but rarities until Duxbury Reef is reached, and it is safe to say that they will never be of commercial importance.

Haliotis wallalensis, Stearns, is a small species distributed along the coast between Westport and the Russian River, a distance of about a hundred miles. Although it is often found in numbers sufficient to be of importance to local users, it is small and little valued save for the very beautiful shells. Despite the extensive use made of abalones, the species has, to our knowledge, only occasionally been found south of the Russian River, namely at Monterey, where it is regarded as a curiosity.

It is here regarded as a species distinct from the green abalone of southern California, which it resembles in appearance. The type locality of the species is Gualala, where it was found by the writer in abundance, as also at Abalone Point near Westport. A single specimen was obtained at the Russian River, and one was obtained at Monterey from Mr. Ernest Dalder. Local inhabitants often fail to distinguish it from the young of the red abalone. It reaches, however, a length not greater than five and one-half inches, has five or six open holes (instead of the three or four of the red abalone), and the edges of these holes are not elevated.

In conclusion, it is evident that there is but the one species of importance found in northern California, namely, the red abalone, and all the commercially valuable beds of that are found south of Shelter Cove, over slightly more than half the length of the coast between San Francisco and the Oregon line.

SOME NOTES ON DRY-FLY FISHING. No. 3.

By R. L. M., California.

I do not believe that any one will disagree with the statement that it requires a little more skill to cast and deliver a dry fly properly than is needed to throw a wet fly. Such being the case, what are the principal factors that tend to promote or assist the skill thus demanded? There are several, among which the rod is one of the most important.

It is true that Mr. G. A. B. Dewar ("The Book of the Dry Fly," London, 1897) is rather inclined to underrate the efficacy of first-class equipment. He writes: "It is not the rod so much as the hand which wields it that kills the trout." There is no doubt about the correctness of this statement, and if we were all as skillful as the talented author of this book, no more would need be said on the subject of rods.

But unfortunately very few of us are able to devote more than a much too brief period to the delights of angling, and such being the case it behooves us to take every advantage that we can and to obtain

everything that will enable us to meet the trout on a more even footing. Therefore we should equip ourselves with the best that modern ingenuity and skill can produce.

Casting or throwing the line out over the water is performed by the action of the rod which gets its initial impetus from the hand of the fisherman.

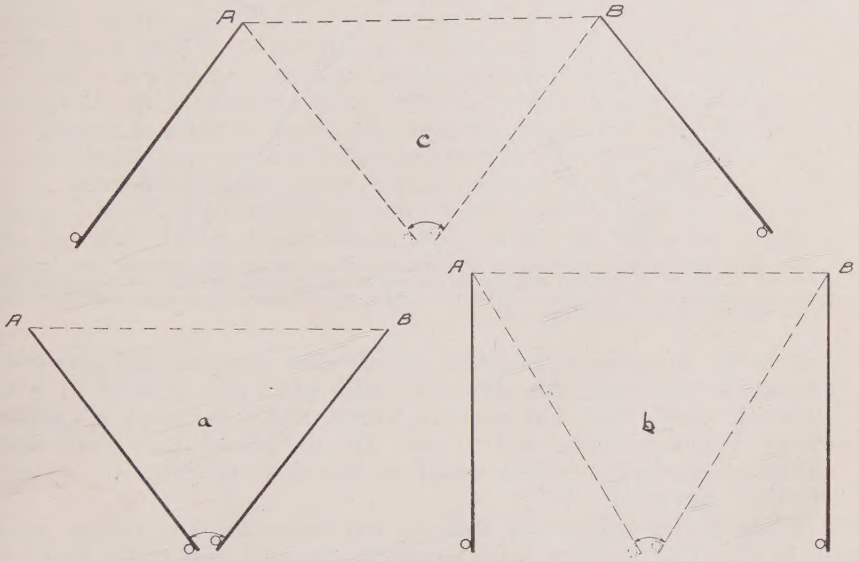

FIG. 19. Diagrams showing the mechanics of fly casting. Although the tip of the rod may be moving at the same speed in a, b, and c, yet in the first instance only would the line be properly cast.

In figure 19 "a" is a diagram meant to represent the rod at two instantaneous moments, viz, at the beginning and the end of the stroke that is made when casting. The tip of the rod, to which the line is connected, moves from A to B. Now if we could move the tip of the rod from A to B with the same speed as in "a," but at the same time while doing this, move the lower point of the rod an equal distance, we should not be able to cast (see "b," figure 19) nearly as long a line as in the first case. And if it were possible to make a motion with the rod similar to that illustrated in "c" of figure 19, we should find that to all intents and purposes we could not cast the line out at all. Yet in all these three cases the tip of the rod (to which the line is attached) would be moving through the air at the same speed. From the foregoing we can deduce that something more than plain motion of the tip of the rod is required in casting, and by regarding "a" again we shall decide that circular, or as it is called in mechanics, an angular motion of the rod is necessary to propel the line. But why does this angular motion produce results when the others fail? The answer is found in "a" of figure 20. The weight of the line and other causes prevent the tip of the rod from moving in synchronism with the lower parts and by the time the end of the stroke has been reached the rod is bent to the fullest extent that is possible for the

particular weight or length of line being used for that individual case. The position of the rod at the end of the stroke is similar to that of a bent spring, ready to fly back to its unstrained or natural position (i. e., straight).

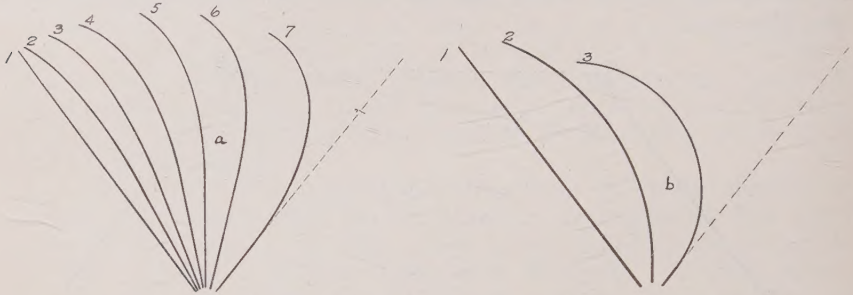

FIG. 20. Successive positions of the fly rod when in action, showing the "snap." It is the recovery of the tip similar to the action of a bent spring that furnishes the necessary impetus to the line. In b the action is too slow to be very effective, due to the bending qualities of the pole.

It is the recovery of this bent spring that furnishes the necessary impetus to the line. An absolutely stiff rod with no bend to it at all would cast a line, but not any length of line to speak of, and it would be a very tiring rod to use. On the other hand a rod with unlimited bending qualities would be too slow in action to be very effective (figure 20 "b").

While we have figure 20 fresh in our memories, and before going on to the other matters, I may remark that this illustration helps to demonstrate the correct manner of making a stroke with a fly rod. The casting stroke (whether backward or forward) should be started slowly, the speed should be continually increased to the end, where a more or less abrupt stop is made. This can only be done if the rod is held tightly or firmly by the hand.

When fishing with a wet fly all that we have to do is to lift the line off the water and cast it back again (figure 21 "a." But when using a dry fly, nine times out of ten we have to dry the fly before returning it to the water. This means that instead of finishing off the forward

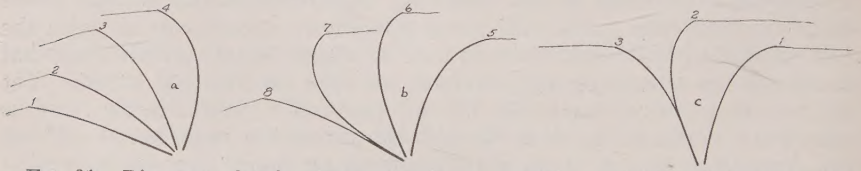

FIG. 21. Diagrams showing the mechanics of the false cast utilized in drying the fly in dry-fly angling. The line is checked before it reaches the water and is returned behind the angler, as in c.

stroke as at "8," figure 21 "a," we must be able to check the line before it reaches the water and return it behind us again. This is what is known as a "false cast" and it may be necessary to make four or five or even more false casts before the fly is dry enough to float once again. Figure 21 "c" illustrates the manner in which the forward stroke is checked when making a false cast.

It is in the making of these false casts that the virtues of a dry-fly rod become apparent. Quite a number of people think that the only difference between a dry-fly rod and a wet-fly rod is that the former costs more than the latter. Such, however, is not the case by any means. If we want a rod capable of extending a line of any length backwards and forwards in the air, we must have a rod that is able to impart the necessary impetus to the line with the least amount of angular motion possible.

In figure 22 I have shown the difference between the actions of a wet and a dry-fly rod; both are supposed to have an equal length and weight of line attached to them. Now it will be noticed that owing to the greater bending of the wet-fly rod, somewhat more vertical motion is imparted to the line than is the case with the dry-fly rod. In practice (i. e., when fishing) this extra vertical motion would mean that when using a wet-fly rod for dry-fly fishing there would be a probability that the fly, when being dried, would either strike the water in front, or

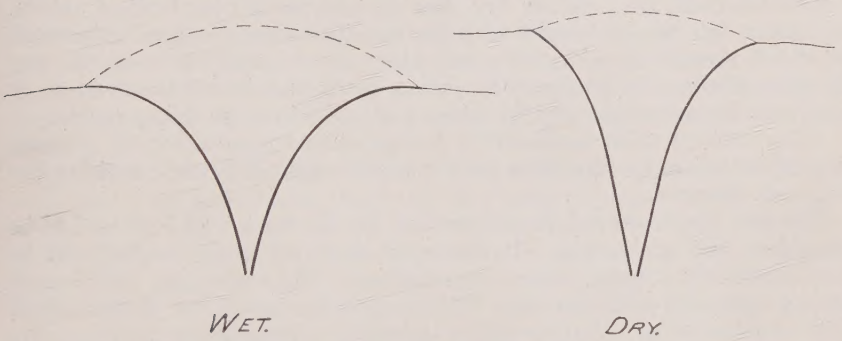

FIG. 22. Diagrams showing the difference in action between the wet and dry-fly rod. Owing to the greater bending of the wet-fly rod a more vertical motion is imparted to the line than is the case with the dry-fly rod.

catch up in the grass behind the angler; whereas, the same length of line could be easily extended in both directions without any danger of such mishaps if a good dry-fly rod was substituted for the wet-fly rod. A dry-fly rod is able to accomplish this because it has more resilience or more snap to its spring than a wet-fly rod has. We may therefore conclude that there is something more than a mere matter of price between a wet and a dry-fly rod. This difference is a structural difference and it consists of making the lower portion of a dry-fly rod much stiffer, i. e., less susceptible to bending than is the case with a wet-fly rod. Then again the middle section should be stronger or stiffer, because in the dry-fly rod the effective bending portion of the rod has to be concentrated within a shorter length than in a wet-fly rod. In both these lower sections the extra or added strength can only be obtained by putting more material, whether cane or wood, into the rod; but when we come to the uppermost portion or the tip, this must be delicate enough to enable us to use the very finest of leaders. It is a fact that a skillful dry-fly man uses finer leaders to land fish of two

pounds and over than the wet-fly man would care to use for the capture of trout of a quarter of a pound or less.

Now when we carefully consider the necessary qualifications demanded of a dry-fly rod together with the fact that the weight must be kept down to very small proportions, is it any wonder that all this refinement means a somewhat higher price for a dry-fly rod than is asked for the other type of rod? I do not want any one to run away with the idea that I am criticising wet-fly fishing. We are all familiar, at least I presume all my readers are familiar, with wet-fly fishing, and I am using wet-fly methods solely as a basis for comparison. For instance, I might say "John is a very tall man." But that does not give any very exact information; but if I said "John is six inches taller than Henry" it would not necessarily mean that Henry was short (he might be a six-footer); but it would give one a very clear idea as to just exactly how tall John really was, provided of course that he was familiar with Henry.

Each method, i. e., wet or dry, has its own particular field of action, and when fish can be caught with the wet fly it is a needless refinement to attack them with a dry fly; but when once a man has used the dry fly successfully, the tendency is, owing to its wonderful fascination, to continue the use of the dry fly whenever and wherever it is possible.

After having thus, successfully I hope, cleared my skirts of imputation of criticism or aloofness to the wet-fly school, I will continue the original theme.

The best length of rod for all-around dry-fly work will be found to be nine feet and six inches. If, however, most of one's fishing will be done on small streams where long casts are the exception, this length can be reduced by six inches. Do not expect to get a rod of the length first mentioned of featherweight lightness. Somewhere between five and six ounces will be as light a rod as it is possible to get and still maintain the necessary strength required. A nine-foot rod will be possibly one ounce lighter. Our grandsires used much longer and heavier rods. Francis Francis ("A Book on Angling," 1867) mentions four rods ranging in weight from 13 ounces, 4 drams to 14 ounces, 6 drams and in length from 11 feet, 7 inches to 12 feet, 8 inches. He, however, preferred a double-handed rod for his own use and he mentions two favorites, viz, 14 feet, 6 inches and 15 feet, 2 inches long. Lord Grey remarks on the wonderful accuracy with which Mr. Francis cast a small fly with such a large rod (p. 113, "Fly Fishing," London, 1899).

The reason why we are today using such shorter rods than formerly is chiefly owing to the introduction of the six-piece split cane rod.

David Foster ("The Scientific Angler," London, 1882) draws a comparison between the length of rods used in Walton's time and that of those which we use now. Charles Cotton, who wrote the second part of "The Complete Angler," and which was incorporated in the fifth edition (1676), gives five or six *yards* as being the best length for a fly rod which should be "made of fir wood for the two or three lengths nearest the hand and of other wood nearer the top." What that "other wood" was history does not relate.

Richard Brookes ("The Art of Angling," 1740) says practically nothing about rods, but Thomas Best, who wrote another "Art of Angling," 1787, specifies in his quaint way.

Ash	7 feet	
Hazel	7 feet	
Yew	2 feet	
Whalebone		6 inches
	16 feet	6 inches

In my copy, which is the fifth edition (1802), the same lengths and materials are given but not in this peculiar form, which reminds one of bookkeeping.

The action of these old-time rods was what we should call "very slow." By that I mean that when bent they were very slow in recovering to a straight position. Such being the case, it was necessary to have a long rod if the fly was to be cast any distance at all to speak of. Furthermore the rods could not begin to carry lines of the weight we use today. In Walton's time hair lines were used; during the early part of the nineteenth century a line of mixed hair and silk was the best that could be got, but when solid braided and dressed silk lines came in all the others were relegated to the scrap pile.

In connection with these ancient rods it is extremely interesting to read about the importance these old-time authors placed on the direction of the wind. It was a *sine qua non* with them to have it at their back. Some of them assert that it is impossible to cast against the wind, but even when they do admit that it can be done, they say it is a very difficult feat to accomplish successfully and warn the beginner against trying to do it. Everybody, however, did not use these double-handed rods. Colonel Hawker, in the fewest possible words, votes for a single-handed rod 12 feet 3 inches long; Pulman ("Vade Mecum," 1841) selects a "small rod about 11 feet long" and Francis Popham, who was a member of The Houghton Fishing Club from 1822 to 1858, was noted as having always fished with a single-handed rod.

Up to the time of the introduction of the close-grained tropical or subtropical woods there was no very great progress made in reducing the length of fly rods; but when these woods made their appearance, rod makers were not long in discovering their adaptability for light fly-casting rods. Greenhart, which is the best of all wood for this purpose (Wells "Fly Rods and Fly Tackle," N. Y., 1885), was first mentioned by Stewart in his "Practical Angler" (1857), but he classes it with logwood as being too "brittle and heavy," from which we must conclude that the greenhart he had in mind was not a particularly good specimen.

Mr. W. A. Hunter, manager for C. Farlow & Company, St. James Square, London, W., writes as follows in connection with this wood:

> Greenhart is not mentioned in the official records of the International Exhibition in 1851, and though our firm exhibited rods then, the kind of wood used is not mentioned, and we have no clear records left of that time.

It would seem from the above (taken in conjunction with Stewart's remarks) "that greenhart was first used in the manufacture of fishing rods somewhere about 1850-1857."

I have quoted Mr. Hunter, because of the fact that Farlow & Company have for years had a very great reputation for their greenhart rods.

A really good greenhart rod is a delightful weapon with which to cast ordinary fishing distances, and some of the men who have used them for a long time can not be induced or made to believe that there is something better than greenhart. The disadvantage of greenhart and all wooden rods is that in our dry climate they may in time become brittle, and when least expected and nearly always at an inopportune time, they have a habit of breaking off short at the junction of the wood and a ferrule. A well-made split cane rod will *never* break if treated as it should be. Whenever a man is seen at the waterside with a broken split cane rod, there are only two possible reasons for the fracture: one is that the rod was a worthless piece of goods to begin with, and the other is that the owner used it for something for which it was never intended.

With the modern six-strip cane rod, owing to its strength and resiliency, it is possible to cast a heavy line, to cast it to distances undreamt of by the earlier generations of anglers, and furthermore to cast across or right into the teeth of any wind short of a hurricane.

The only advantage that a long rod can have over a short one is that more command may be had over a hooked fish; but the rod is *not* the weak link in the chain; the weakest link is the extremity of the fine gut leader; *that* is really the factor that decides how much force we can use, and not the strength or length of the rod.

For comfort in fishing the handle or hand grasp should be made large enough so that no part of the hand is in contact with any metal. Furthermore the diameter of the handle should be such that the muscles of the hand do not become cramped by holding the rod. A rod handle that may seem comfortable enough for wet-fly fishing becomes a veritable torture if used for dry-fly casting owing to the fact that we have to cast so much more frequently. I refer to the false casts necessary to dry the fly. A properly shaped handle does not exactly add to the artistic lines of the lower extremity of the rod, but it *is* an infinitely pleasanter thing to fish with. It is a very great mistake to imagine that a rod can be made *effectively* lighter by paring down the handle. The balance of the rod is obtained by the weight of the reel and frequently, in fact nearly always, the reel and the line on it are not quite heavy enough to give a correct balance. If we take a rod into our hands and, without attaching the reel, we make a few strokes in the air with it, we at once notice that it feels top-heavy, or in other words there is a distinct sensation of weight felt. Now attach a reel or any other form of weight to the reel seat. The heavy feeling that the rod had has now vanished, or else it is not so noticeable. To arrive at a correct balance it is best to attach a moderate weight first and gradually increase it until the top-heavy sensation has completely disappeared. But note this: Sufficient weight must not be added so as to induce a too lively feel to the rod. If this is done the rod will be "over-balanced"

and although the effort required in casting will be reduced to a minimum, the accuracy and control of the line will be to a great extent lost.

The fully equipped rod should balance at a point about three to five inches above the upper end of the handle (or hand grasp). There is no rule or formula by which this point can be found. The only satisfactory way is by the trial of various weights as already explained. When the correct weight has been found, deduct the weight of the reel and line from this, and make up the remainder by an equal weight of soft lead wire, which can be wound on to the empty spool of the reel before the line is wound on. The best type of reel to use is a contracted single action click (adjustable) one. With such a reel the line can be wound in as fast as with a multiplier; the spool is short or narrow but the diameter is large. The best that have been procurable up to the present have been the best grade of English made reels (See "Saturday Evening Post," August 9, 1919; "Very Efficient" Camp in "Fishing with Floating Flies," 1916; Geo. P. Holden "Stream Craft," 1919, says they "are exquisite"), but one of the leading American reel companies will shortly place a first class fly reel on the market.

Charles Zibeon Southand, in "Trout Fly-Fishing in America," 1914, gives a table of lengths and weights of rods and the proper weight of reel to balance them. He bases his table on the supposition that the reel should weigh half again as much as the rod. Using this table as a starting point a four-ounce rod would call for a six-ounce reel. A 3½-inch reel will weigh about five ounces, which gives us one ounce of margin for the line. If this is not enough a slightly smaller reel weighing less could be used. However, it will frequently be found that the very light rods need a lot of counterweight to properly balance them.

A 9½-foot, 6-ounce rod that I use a great deal for dry-fly fishing is perfectly balanced by a total of 9 ounces made up of reel, line and lead wire.

A tapered oil-dressed silk line is the only one to consider in connection with this kind of fly-fishing. These lines are prepared by soaking them in pure boiled, or cold pressed, linseed oil. Mr. Martin E. Mosely, one authority, advocates the former; and a description of his method will be found in Halford's "Dry-Fly Man's Handbook." A copy of this (i. e., the line dressing) appeared in "The American Angler," December, 1918, under the heading "Dress Your Own Line." Another great authority on this subject, viz, Mr. W. D. Goggeshall (an American and past president of The Fly-Fishers Club, London), writes in a recent issue of "The Fishing Gazette":

> Never use air pump; always put line in *hot* oil; heat oil so hot that it will burn your finger, put line in oil, keeping heat up until air bubbles seem to rise; take off the fire and allow line to cool in oil and hang line up to dry. Better to *stretch* line first, though. To get a *perfect* surface apply cold oil when line is stretched and dried. Be sure that *every* coat is *thoroughly* dry before second coats are applied. Rub down smooth and polish with soft rag and talc powder.

Mr. Perry D. Frazier, of Ridgewood, N. J., who is the author of one or two books on angling matters, manufactures oil dressed lines that compare very favorably with the best imported article.

Different methods are used for gauging these tapered lines. Some manufacturers call them "No. 1, 2, 3," etc.; others use the alphabet and specify "D, E, F," etc.; consequently unless we know the *weight* of the line it is not much use saying that such and such a rod should have an "F" or "E" line, as the case may be. The line should fit the rod. By this I mean that the line should be sufficiently heavy to fully develop the casting power of the rod. If the line is not of sufficient weight when the casting stroke is made the rod will not be bent far enough to fully develop its spring (see figure 20) and it will take considerably more effort to cast the line than would be necessary if the proper size or weight of line was used. On the other hand, a line that is too heavy for the rod will in a very short time completely ruin it.

For ordinary occasions, i. e., when the wind is not too strong, a 9-foot tapered leader is advisable. It should be tapered from fairly heavy gut at the upper end down to the "finest undrawn" at the lower extremity. Finest undrawn gut is approximately the same sixe as X drawn gut; but the undrawn gut is about 15 per cent stronger than drawn gut of equal diameter. These undrawn gut leaders are very scarce and extremely hard to get hold of; consequently most of us will have to be content with leaders whose fine points are made of drawn gut. Drawn gut is listed as X, XX, XXX, etc., but anything less than XXX is rather too fine for the sort of fish we hope to catch. I might mention, however, that trout of over five pounds have been caught on XXX leaders.

When a strong wind is blowing the length of the leader should be reduced to 7½ or even 6 feet, but do not make this reduction by cutting off from one or other end of the leader. Get these short leaders made up just the same as the longer ones, i. e., fully tapered from end to end. I do not believe there is any economy in buying gut in hanks and making up one's own leaders. To make up a good tapered leader several hanks of gut would be required.

There are 100 strands in each hank and if they were all made up into leaders we should probably have about 70 or 80 leaders on hand. Gut does not improve with age; consequently long before we got to the end of our leaders we should find that they were beginning to deteriorate and in all probability the last few dozen would have to be thrown away, thus wiping out at once any paper profit that might have been theoretically possible. Some people will tell you that they always make up their own leaders and that bought leaders are no good. There is but one answer to this and it is: Where did they buy these poor leaders? If leaders are obtained from reputable houses and a good price is paid for them they will be all that any one can desire and much better than 99 per cent of us could make for ourselves. I always aim to use up my leaders every season and not to carry any over to the next; then I know that the leaders I am using are the best that can be got and are not weakened in the least by age. There are several substitutes for gut. They generally have queer sounding names and are not as strong as gut of equal diameter. They are more opaque than gut, and when they get wet they become so soft and limp that they do not lay the fly out over

the water properly; therefore, they are not to be thought of in connection with dry-fly fishing.

There are several other appliances peculiar to dry-fly fishing and I will mention them briefly. The first is the "line greaser" which is a little folded leather pad which has several sheets or folds of cloth inside. These are liberally doped with some grease, such as red deer fat, mucilin, vaseline, or mutton fat. Before commencing to fish the line (not the leader) is rubbed down with the greaser in order that when it is cast it will float on top of the water. Then there is the oiling device. This may be a small atomizer, or a little bottle with a small brush, or a small metal box with some felt pads well soaked with the oil used to assist the fly in floating. Oil is not necessary to make the fly float. Before it was used flies were made to float and some men still refuse to use it; but all said and done, oil is a wonderful help. When it is used a fly will never become quite as wet as it will if it has not been annointed, and furthermore a wet fly that has been oiled can be dried much quicker than an unoiled fly. The dry-flies are kept in a box and not in a book, because they should not be crushed. There are numerous kinds of fly boxes on the market and I hope to give illustrations of several of them in one of the future series of these notes.

A landing net is one thing that can not be dispensed with. It should be large and have a handle of fair length. There are a number of folding nets on the market. Some are too small for anything but very little fish. A span of sixteen inches across the mouth of the net is not too much, and the net itself should be at least twenty inches deep. It is much better to have a landing net of the large size than to have one that is too small. Imagine the feelings of a fisherman with a five-pound trout ready to land, and a net so small that it would be difficult to lift out the fish with it even if the fish were dead. The best thing to do in this case is to throw the net away and pull out a handkerchief and, taking this in your hand, lift out the fish; but be quite sure the fish is all in before you try to do so.

And finally there is the creel or basket in which to put the fish we expect to catch. Get a good-sized one, one that will take a two-pound trout without bending the fish. Above all things get one that is not easily opened, for two reasons: if it opens easily it may act without your knowledge and dump some of your fish on the scenery; and if it is easily opened some inquisite stranger may casually open it when there are no fish inside for the I. S. to admire and for the owner to feel proud of.

Having briefly described the implements used in the art, I propose to give a demonstration of their use in the next issue of CALIFORNIA FISH AND GAME, which will be before the public just about the beginning of the vacation season.

THE MULLET FISHERIES OF SALTON SEA.

By Will F. Thompson and Harold C. Bryant.

The Salton Sea is, in reality, a portion of the Gulf of California, cut off by the enlargement of the delta of the Colorado River. It has been, consequently, evaporated to relatively high salinity during each of the long periods when the Colorado River emptied its waters into the gulf. Geologists believe, in fact, that the river has periodically emptied its flood in to the Salton Sea, raising its level, and extending its area, just as it did during 1906. At present the Colorado is prevented from doing this by the dikes along its banks, built in order that the Imperial Valley may be safe, and that it may be irrigated, but the irrigating canals carry a certain amount of waste water into the sea. There are, in addition, fresh water springs, notably one called Fish Spring, which pour considerable amounts of fresh water into the sea.

Little is known about the fisheries of the Salton Sea before the last break in the jetties of the Colorado River. In 1905 the water of the Colorado River poured down what are now known as the New and Alamo rivers in a great flood which carried 160,000,000 cubic feet of water into the sea daily. The result was a great enlargement of the sea and the extensive freshening of its waters. The extension of the sea buried the Southern Pacific lines along its shores, covered the adjacent territory which at that time was beginning to be placed under cultivation, and threatened great financial loss to the Southern Pacific Company, which owned alternate sections of land throughout the territory. In 1906 the break was closed by the Southern Pacific Company, after a spectacular struggle. It was through this break that the fishes now, or recently, present, entered the Salton Sea.

During the earlier portion of the period since 1906, considerable numbers of "carp," if the indentification of others than scientists be trusted, were to be found in the sea, and some eight years ago a promoter started a company with the idea of using these carp, and other fresh water fish, for oil and fertilizer. Having built the proper buildings, installed machinery and launched boats in the sea, the company was unable to operate because it was unable to find sufficient fish. At this time, Captain Chas. Davis, who came originally from New England and was familiar with fisheries of all sorts from an extensive experience on all our coasts, went to Salton Sea to investigate the likelihood of extensive fisheries being built up. His report was adverse. The company for some time endeavored vainly to dispose of the equipment, but was unable to until they accepted Davis' offer of $500. The latter then scrapped all the machinery, turned the buildings into a pleasure resort for the people of the valley, and took up land in the vicinity when the sea had subsided sufficiently. The buildings are now more than a mile from the sea.

However, five years ago, in 1915, mullet (*Mugil cephalus*) began to appear in the sea, and Davis placed weirs of wire netting along the shallow shores of the sea to impound them. He was able to obtain a

large amount of fish at times, but could not develop a market for them at the time, even in Los Angeles and San Francisco. Attempts to sell the fish in the Imperial Valley were fruitless, the fish being named "cow-carp" and regarded as very poor. These attempts, however, laid the foundation for a later very good demand. The approach to Captain Davis' land being cut off by the overflow from irrigation ditches, he was prevented from pursuing the fishery until the last year, but certain Japanese and Greeks did catch considerable quantities, using much of the mullet for oil, and shipping some to market. The Greeks still operate. In the last year Captain Davis has again begun shipping mullet, catching them by means of halibut trammel nets. The catches during the winter months by two men using eight trammel nets of thirty fathoms length each, comprise but 250 or 300 pounds daily, taken in the vicinity of the mouths of the rivers, in shallow water. These fish are landed and shipped from Niland to Los Angeles or San Francisco. Captain Davis receives 15 cents per pound for the fish at the station.

FIG. 23. Captain Charles Davis, a mullet fisherman of the Salton Sea, Imperial County, California. Photograph by H. C. Bryant.

The recession of the sea has made considerable trouble so far as landing the catch is concerned. As the fall is only about four feet per mile, there are great flats covered with water only six or eight inches deep, in which a boat can not easily be moved. Captain Davis has in

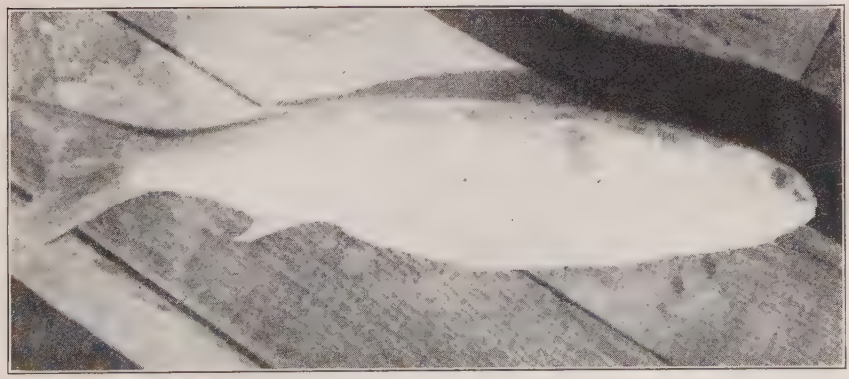

FIG. 24. The mullet (*Mugil cephalus*), a desirable food fish now found in numbers in Salton Sea, Imperial County, California. Photographed by H. C. Bryant.

a measure overcome the difficulty by making a shallow canal, up which his boat can be pulled part way by means of a picket line and the remainder of the way can be pulled with a tow line.

According to Captain Davis mullet are found in different locations in the sea at different seasons. During part of the year they are found in great numbers on the west shore of the sea in grass which grows profusely there and upon which they feed, being vegetarians. On a visit to Bird Islands, on the west shore of the sea, on December 18, 1919, there was no evidence of mullet, and yet at times large numbers are said to be caught in this vicinity.

The fish are at present of very large size indeed, being between two and two and one-half feet in length. The flesh is oily in the extreme, yielding fully a quart of clear oil to the ten pounds of fish. This oil, of a delicate flavor, renders the canned mullet a delicacy, and samples put up by a Los Angeles firm were found to be very palatable. The fact that the fish is delicious should have been expected because of the very high esteem in which it has been held from ancient times, domesticated mullet being known in Europe since the times of the Romans. The species is found all along our coasts, from Monterey southward, and occasional schools are taken in every sheltered lagoon or bay, as well as occasionally up the rivers in what is really entirely fresh water. Its occurrence in the Colorado River is not highly remarkable, and its transference to the Salton Sea would have been expected by anyone familiar with its habits.

FIG. 25. Mullet fisherman with part of his catch. Photograph by H. C. Bryant, December 19, 1919.

There is also present in the Salton Sea a species of top-minnow *Cyprinodon macularius,* which is found in the streams and springs of the desert throughout Southern California and parts of Mexico. They are said to be abundant in the sea at times, and specimens were obtained for us from there and from Fish Spring by Captain Davis.

It is, indeed, very questionable whether the mullet will exist for any length of time. The carp, and other fresh-water fish in the sea, died some years ago, according to Captain Davis' recollection, after a heavy blow which mixed the waters, drifting them ashore in great quantities. During the past two years there have been statements made to the effect that the mullet also have been found on certain shores of the lake in great quantity, apparently dead from poisonous waters. It is certain, moreover, that the sea has been steadily falling, at the rate of 4½ feet yearly, and as the sea is everywhere shallow (perhaps 25 or 30 feet

deep) it is plain that it can not last long at such a rate of fall. Analysis of the water at a distance from river mouths shows it to be three or four times the salinity of ocean water. The water, moreover, is not merely saline. If such were the case, it is probable that the mullet, a salt water fish, would survive indefinitely. But as a matter of fact the water is fed from alkaline springs, and has in the past been alkaline in nature, so that the water must become poisonous rather than merely salty. Regarding this, however, there is some question until chemists are able to analyze fair samples taken annually, but the probability is very great that the mullet will be unable to exist.

The area near the center of the mullet fisheries should prove of great interest to the geologist. Mullet Island is a typical volcanic plug. At the edge of the island a number of hot springs boil out, leaving chemical deposits of several colors, similar to those of Yellowstone National Park. Captain Davis, by impounding the waters of these springs, has succeeded in obtaining two different colored "paints," and in a third reservoir a pure deposit of rock salt Near the island are some mud volcanoes the cones of which are from five to eight feet in height. A spring in this vicinity also is geyserlike in action, boiling out with considerable velocity periodically. Because of these natural phenomena the island is visited by large numbers of people from the Imperial Valley every week.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

APRIL 19, 1920.

"There must be a balance between the agencies of destruction and those of conservation. When there is nothing left to conserve then we must give up all of our ideas of sport."—Emerson Hough.

ADDITIONAL GAME SANCTUARIES.

Through an oversight the list of California's game sanctuaries as given in the January number of CALIFORNIA FISH AND GAME lacks the following:

Name	County	Area	Established
4F	Los Angeles and Kern	23,040	1919
1M	Kern	80,640	1919
3E	Santa Clara	3,840	1919

This adds a total of 107,520 acres which should have been included in the statement, making a total in all of 3,107,520 acres. Sanctuary 4F was set aside especially to protect the few antelope which may still exist in the eastern end of what is known as "Antelope Valley," in northern Los Angeles County.

THE GAME WARDEN AT WORK.

The scene is laid in one of the small national parks in the Southern Sierras. A state game warden, on the look out for violators, is camped within the park for the night. A shot is heard at dusk. The warden gets up early the next morning and goes to the spot from which the shot was heard and there discovers blood upon the ground. A little search also discloses the entrails, head and skin of a doe. The warden hides the head and hide and makes his way to the camp of some woodsmen just outside of the park. A man found at the camp is asked if he has any deer meat. He replies "No." The warden notes on the back of the woodsman's hunting coat a large patch of blood, apparently made by carrying a deer into camp. When questioned the woodsman states that he does not know what caused the spot of blood. The warden asks permission to enter the cabin and make a search and is given this permission. On entering the cabin the warden discovers a flour sack filled with fresh venison. The woodsman then admits that his brother has killed a deer. He is then asked if the deer was killed within the national park and is told that it was not. The game warden then leads the woodsman to the spot where he had hidden the head and hide of the doe and the woodsman is made to admit the fact that the doe had been killed within the national park. The outcome, of course, is a heavy fine to the violator.

In California game wardens can tell you many such stories as the above. The violator is nearly always a man ready to perjure himself and do anything to avoid a court sentence. Talk to a game warden and you will soon discover that it is not the detective alone who must be clever in sleuthing and in the gathering of reliable evidence, for the game warden must not only act as police and prosecutor, but he must also be a clever detective, if he is to bring violators to justice.

DRY YEARS INJURE ANGLING PROSPECTS.

Dry years are coming to be viewed with grave apprehension by the angler, for he knows that his sport is always curtailed by a lack of water in the streams and lakes. Planting activities have been coming to naught as a result of the lack of water. In many streams and lakes where large numbers of fish have been planted, and where a noticeable increase has taken place, there has been a depletion in the abundance of fish due to drought. Two power reservoirs in the Southern Sierras, Huntington Lake and Shaver Lake, although heavily stocked in the past few years, will furnish but poor angling the coming season because of the fact that thousands of fish have died

owing to the present low water and consequent poor food supply. Many streams when they again run bank full will contain but a small proportion of their former stock of fish. Every angler should look with favor on future storage reservoir projects, for in an increase of such reservoirs lies a partial solution of the problem which presents itself with each dry year and its consequent low water.

GOVERNMENT AND FISH AND GAME COMMISSION INAUGURATE FREE NATURE GUIDE SERVICE.

So successful was the summer resort work inaugurated by the California Fish and Game Commission at the Tahoe resorts last summer, that it drew the attention of the federal government, with the result that a similar nature guide service will be installed in the Yosemite Valley the coming summer. The Superintendent of National Parks has secured the cooperation of the Fish and Game Commission to the extent of the commission's furnishing Dr. H. C. Bryant, who instituted the work at the Tahoe resorts, for the work in Yosemite. Dr. Bryant will be assisted by Dr. Loye Holmes Miller, of the Southern Branch of the University of California.

Evening lectures dealing with wild life will be given at the various camps and trips afield will be conducted, including special trips for children. Office hours are to be arranged so that questions regarding natural history can be answered. This summer resort work offers a splendid opportunity for the Fish and Game Commission to employ the educational method in making conservationists out of summer vacationists. In no other way could the commission come in touch with so large a number of people in so short a period of time.

IN MEMORIAM.

CHESTER A. SCROGGS.

We regret to announce the death of Deputy Chester A. Scroggs, whose death occurred January 29, 1920, after a short illness at his home in Loomis, Placer County.

Deputy Scroggs was appointed special deputy June 19, 1908, and regular deputy September 1, 1911. He was attached to the Sacramento Division, and for three years up to the time of his death was in charge of the launch patrol of the district. By his activity and thoroughness he developed this arm of the service up to its present stage of efficiency.

Chester Scroggs was utterly fearless and resolute in the discharge of his duty. He believed the fish and game laws were placed on the statute books to be enforced. There was no obstacle or hindrance too great to deter him from his duty as he understood it. Nothing could deviate him from his purpose. If he had a fault it was over-zealousness—if that can be termed a fault. He had no censure for any but the slacker of duty. Still he was fair and conscientious in his dealings with violators with whom he came in contact. They both feared and respected him.

At the time of his death he was forty years of age. He is survived by a widow and two small children, a boy and a girl, also a sister. He was a member of the Masonic fraternity and the Order of Elks.

He is mourned by his many friends in private life and his brother workers on the Fish and Game Commission.

FOREST NESBITT.

Deputy Fish and Game Commissioner Forest Nesbitt died of pneumonia at his home in Salinas, Friday, March 5, 1920, after only a few days illness following a severe cold contracted while on patrol duty.

Mr. Nesbitt was appointed Deputy Fish and Game Commissioner, December 1, 1917, after qualifying by civil service examination. During his time of service, he proved his fitness for the trust that was placed in him. His training under his father, who has been sheriff of Monterey County for many years, gave him previous experience that was of the greatest value. In every prosecution his fairness was apparent. No one was taken into court unless their guilt was certain. Believing in the strict enforcement of the laws protecting wild life, his influence brought about a better compliance with the law in every section to which his work took him.

To the father, mother and wife and others that were near and dear to him, the Commissioners and fellow-employees extend their heartfelt sympathy.

FOREST OFFICERS' REPORTS.

For several years past the Forest Service has, through the medium of annual reports from each supervisor, furnished valuable information as to the distribution and past and present status of fish and game. During the coming year forest officers are to furnish information according to the following outline recently submitted to them. As can be seen the outline emphasizes knowledge as to distribution and life history of the more notable species.

LIFE HISTORY.

A. Big Game.

Moose, elk, antelope, mountain sheep, white-tailed deer, black-tailed deer, black and brown bear, silver tip or grizzly bear.

Mating and breeding habits, number and care of young, food and range at various seasons of the year, condition and abundance, diseases and effect of climatic conditions, rutting season, when young are born, when are horns shed, any other information bearing upon the desirability of the species or its adaptability for extension work.

B. Game Birds.

Ducks and geese and other waterfowl, if any; grouse, give exact species found; quail, partridge, pheasants, ptarmigan, etc. Anything relative to their breeding and nesting season and habits. When eggs are laid and number of young, abundance or scarcity.

C. Small Game.

Rabbits, tree squirrels. Their relation to forestry and value as game animals, abundance, or scarcity, need for protection, if any.

D. Fur Bearing Animals.

Species found in locality, breeding habits, season when fur is prime and value. Any available information as to the extent of the local trapping industry. Special attention to beavers.

E. Insectivorous and Song Birds.

List various species found together with all interesting information at hand concerning life history and habits.

F. Predatory Animals.

Wolves, coyotes, mountain lions, foxes (various species found), wild cats, lynxes, etc. Specific cases of loss by predatory animals.

Damage done by these species to game. Abundance or scarcity. Range and food at various seasons. Any useful information in exterminating them not hitherto reported.

(Note—Several of the species listed may also be discussed under Fur Bearing Animals.)

G. Predatory Birds.

Eagles, hawks, etc., various species found. Amount of damage they do to game animals and birds. Life history and habits.

H. Fish.

Trout—rainbow, eastern brook, native and others. Bass—small and large mouth. Other game fish—abundance or scarcity of species, spawning season, migration, character of water best adapted to each, use of fish ladders and screens. Information as to any successful device for screening headgates or ditches is especially desired.

Streams needing stocking; number of fish needed for each, with specific shipping instructions. Cost to Forest Service, amount of cooperation, etc.

DISTRIBUTION.

In submitting the above report, information which will extend the known ranges of the following mammals and birds is very much desired. Below you will find a list giving you a brief summary of the range of each species. If you locate definite records of the occurrence of any of these birds or mammals outside of the limits given, do not fail to submit evidence. The best evidence is a specimen. Ship specimens direct to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, California, by express, carefully marked "specimens for scientific purposes." We are especially anxious to get specimens of deer taken in San Luis Obispo and Santa Barbara counties and throughout the Sierras to outline more accurately the range of various species. Specimens should be taken during the open seasons. Permits will be issued on application for protected species.

White-tailed Deer.

Range—Said to have formerly occurred in extreme Eastern and Northeastern California, chiefly in the Modoc region. Many accounts by hunters, but no verified or recent report.

Columbian Black-tailed Deer.

Range—Northwest coast region, chiefly in the Transition (yellow pine belt) and Boreal (Lodgepole pine belt upward) zones; east throughout the inner coast ranges to the Sacramento Valley, and at the north to and including Mount Shasta and near vicinity; south to the north side of San Francisco Bay.

Southern Black-tailed Deer.

Range—Transition and high Upper Sonoran (chapparal belt) zones south

from San Francisco Bay through the Santa Cruz district, at least into Monterey and San Benito counties.

Rocky Mountain Mule Deer.

Range—Eastern California, including main Sierra Nevada south into Kern County and north to vicinity of Mount Lassen, thence northeast through the Modoc region. Western limit at extreme north, Mount Shasta (Rowley, M. S.). Not in the desert ranges east of Owens Valley except in winter. Occurs in summer on the high Sierras up to timberline; in winter most numerous in the foothills.

California Mule Deer.

Range—Upper Sonoran and Transition zones of Southern California west of the desert proper, from the Mexican line northwest through the San Diegan district at least to San Luis Obispo County, and east through the Tejon region to the Tehachapi Mountains.

Desert Mule Deer.

Range—Imperial Valley.

Northwestern Timber Wolf.

Range—Northern California, and south along the Sierra Nevada. Now rare or extinct. The number of records (e. g., Price, Zoe, 4, 1894, p. 331) and reports from the region specified carries conviction that a wolf of some form has occurred as above indicated. But lack of specimens brings doubt as to the race represented.

Sierra Nevada Wolverine.

Range—Boreal zone on the Sierra Nevada, from the vicinity of Mount Shasta, south through Lake Tahoe region to Monache Meadows, Tulare County.

Yellow-haired Porcupine.

Range—High Transition (yellow pine belt) and Boreal (Lodgepole pine belt upward) zones along the Sierra Nevada, from Mount Shasta to the vicinity of Mount Whitney.

Sierra Grouse.

Range—Common resident of coniferous timber in the upper Transition and Canadian zones of northern California from Mount Shasta south along the inner coast ranges at least to Mount Sanhedrin, and along the Sierra Nevada south through the Mount Whitney region to the Piute Mountains, Kern County. Also on the Warner Mountains of Modoc County, on the White Mountains, Mono County, and on Mount Pinos, Ventura County.

RECORD ANY RECENT OCCURRENCE OF:

Grizzly Bear.

Columbian Sharp-tailed Grouse.

Former range—Occurred formerly as a fairly common resident on the Transition plains of the Modoc region; Canoe Creek, 50 miles northeast of Fort Reading, and upper Pit River; Camp Bidwell. No information is at hand confirming its existence within the state at the present time.

Sandhill Crane.

(Especially record of nesting.)

Range—Fairly common summer visitant to the northward interiorly; at least a few winter in the San Joaquin Valley. Recorded as breeding in the northeastern corner of the state; summer records also from Alpine Meadows of the Northern Sierras (several records), and from the San Joaquin Valley south to the Tulare Lake region.

Breeding of ducks, geese and jacksnipe in the Sierra region.

A BILL TO ESTABLISH GAME SANCTUARIES IN NATIONAL FORESTS.

With the view that certain areas within the national forests may be set apart as game sanctuaries, a bill was introduced in the United States Senate on June 21, 1919, by Senator Nelson, looking toward the dedication of more of the national lands to conservation purposes. The national parks and monuments have for some time been set apart as game refuges, and the bill in question would also set apart sections of the national forests to the preservation of our wild life. This bill covers practically the same points as a bill previously introduced by Senator Chamberlain, but which never came to a vote by the Senate. The Nelson bill covers the following propositions:

Section 1. A federal law empowering the secretary of agriculture to select areas in national forests suitable for game sanctuaries; these sanctuaries to be established by presidential proclamation but with the approval of the governor of each state; and to be so located that they shall not prevent the allowing of grazing or other uses thereof as are in conformity with the laws applicable to national forests.

Sec. 2. Prohibiting the hunting or other destruction of game within such sanctuaries, except as otherwise in the act provided, and providing penalties for the violation of such provision.

Sec. 3. Administration of the provisions of the act to be vested in the secretary of agriculture, with power to regulate the killing of predatory animals.

Sec. 4. Providing for the establishment by the secretary of agriculture of boundaries and for postings showing the location thereof and warning the public of the prohibition of hunting therein.

Sec. 5. Setting forth the purposes of the act: That it is expedient to establish a large number of sanctuaries of medium

size rather than a few large preserves, the ideal condition to be a chain of sanctuaries, with the view of providing breeding places for game which will spread over adjacent and intervening territory, where it will be subject to the regular open season provided by law.

There is crying need for such a law as this, for millions of acres of some of our national forests are utterly destitute of game, and great opportunities to create a vast annual supply of big game are being wasted by lack of intelligent and resolute action. It is to be sincerely hoped that this measure will not, like the Chamberlain bill, be allowed to slumber in the archives of Congress, but that some definite step will be taken.

SAN DIEGO TO MAKE CLEAN SWEEP OF THE ENGLISH SPARROW.

The city of San Diego resolved that she would rid herself of the English sparrow. So in 1916 a city ordinance was passed providing for ways and means for the extermination of this pest and appropriating the sum of $125 for such purpose. The task of destroying sparrows inside the city limits was delegated to one man, and ever since the ordinance became effective he has been on the job. From the first the campaign has been successful and the sparrow pest is now not only under control, but this spring San Diego expects to free herself entirely of the sparrow. The city this year is allowing ten cents each for every sparrow killed, up to $50, and in addition the Chamber of Commerce is also offering ten cents each up to $30. The record for this year shows 250 dead birds, and it is estimated that there still remains about 100 sparrows in the city. It is expected that as soon as the mating season is well under way and the sparrows begin nesting that a clean sweep can be made of all these remaining birds.

Other cities in the state might well follow the example set by San Diego. Even in cities where sparrows are far more numerous the appropriation of a small sum of money and the appointment of an energetic and ingenious man to carry on the work of destruction will lead to a near solution of the sparrow problem. A city that can advertise itself with the slogan "No house sparrows here" adds to its reputation—Webb Toms.

FISH PACK, 1919.

In this issue is given a complete report of the canned, cured and manufactured fishery products of the state for the year 1919 (see p. 96). Through the cooperation of the packers throughout the state it has been possible to get out the annual pack more promptly as well as more accurately and in greater detail than ever before.

The total case pack of canned goods in 1919 was a trifle over 42,000 cases less than in 1918, while the estimated value of the 1919 pack is nearly $3,000,000 greater than estimated value of the 1918 pack.

During 1919 the tuna, albacore and skipjack pack was larger than in the previous year, and while the actual case pack of sardines for 1919 was less than for 1918, the pack was of a better quality. During 1919 there were only 41,373 round cans of sardines packed as compared to 420,905 cases of round cans for the year previous.

The pack of mild cured salmon for 1919 was nearly double that of the previous year. The production of meal and oil also shows a large increase. At the close of 1919 we find an increase of twelve plants, 203 employees and over $2,000,000 in valuation of plants, which shows the healthy growth of the fish packing industry of California.—S. H. D.

SPORTSMEN LAND MANY BIG FISH.

The total number of blue-fin and yellow-fin tuna taken at Catalina Island during 1919 was 911, of which 36 weighed over 100 pounds each. The total number of marlin swordfish was 114. No broadbill swordfish were captured, but a number of anglers reported unsuccessful battles with them. The prize for the world's tuna taken on light tackle went to Commodore James W. Jump, the fish caught weighing 145½ pounds. The usual awards have been made by the Tuna Club, prizes now being offered for such other game fish as swordfish, white sea bass, bonito and dolphin.

FOREST OFFICERS TO ACT AS GAME WARDENS.

By an agreement recently signed by the Executive Officer of the California Fish and Game Commission and the United

States Forest Service, forest rangers will act as fish and game wardens and deputy fish and game commissioners as forest firewardens. According to the terms of the agreement forest officers will enforce fish and game laws, make arrests, submit reports and issue hunting and fishing licenses. The force of game wardens will therefore be greatly augmented and better enforcement of the fish and game laws is a certainty. The news that forest officers will handle hunting and fishing licenses will be received with pleasure by sportsmen because of the added convenience. The help of the Forest Service in better posting state game refuges will be another outcome of the cooperation planned. In return for the services of the forestry men, the game wardens of the state will be deputized as forest firewardens and will help in protecting the forests and in developing the right public attitude toward the laws and regulations of the national forests. There is to be a continuance of the annual reports on game conditions in the forests furnished by the District Forester.

This cooperation, which has been carefully worked out between the United States Forest Service and the Fish and Game Commission, will make violation of the fish and game laws doubly difficult and will do much to develop a sentiment favoring game conservation. There follows the agreement in full:

AGREEMENT.

In order to secure closer cooperation with the Fish and Game Commission, the following informal agreement has been executed:

Whereas, the wild life on the national forests of California is a product of the forest and a great resource, which adds materially to enjoyment of the national forests by the public, as well as of great economic value, its protection and perpetuation becomes a public necessity; and

Whereas, the Fish and Game Commission of California is the duly authorized agent for the State of California for the protection and perpetuation of this resource, and the District Forester of the Forest Service, United States Department of Agriculture, for the Department; now, therefore

In order to coordinate the work of these departments in the protection of game, fish, birds, and forests of California, Paul G. Redington, District Forester, for and on behalf of the United States Department of Agriculture, and Carl Westerfeld, Executive Officer of the Fish and Game Commission of California, for and on behalf of the State of California, do agree as follows:

1. That under the state laws no differentiation can be made between violators of the law. The law, therefore, should be enforced equally as to all violators.

2. The forest officers, because of their familiarity with the areas on which a large proportion of the wild life in the state exists, can and should assist, by their own personal actions and attitude, in securing the proper respect and enforcement of the state game laws. All forest officers who, in the judgment of the District Forester, can, because of the character of their work, be of assistance in the enforcement of the state fish and game laws, will be appointed by the Fish and Game Commission of California as deputy state game wardens. All forest officers so appointed shall assume the following prescribed duties:

(*a*) Pay strict attention to the enforcement of the state fish and game laws, and by personal actions and attitude assist in creating the right public attitude and sentiment toward the protection of fish and game within the boundaries of national forests;

(*b*) Report all cases of violations of the fish and game laws to the officer's immediate supervisor, who will in turn report the violation to the Fish and Game Commission of California, San Francisco, California;

(*c*) Make arrests for violations of the fish and game laws committed within the boundaries of the national forests;

(*d*) Furnish all information available which will assist officers of the state in apprehending or prosecuting violators of the fish and game laws, whether such violation was committed within or outside the national forests;

(*e*) Submit such reports as may be called for by the District Forester;

(*f*) Report misconduct or dereliction of duty on the part of any state official employed in the enforcement of the state fish and game laws;

(*g*) Issue hunting and fishing licenses, receiving therefor the commission allowed by law.

3. The District Forester will cause an annual report to be submitted to the Fish and Game Commission which shall contain complete information as to the present condition of wild life in the national forests, and plans for the protection and development of fish and game therein. He will recommend the establishment of such game refuges as seem necessary, the boundaries of which shall not be changed without his approval.

4. The Fish and Game Commission of California will elect a representative of its commission to act on behalf of the Commission with the District Forester on all matters pertaining to fish and game work on the national forests of California.

5. The duly authorized agent of the Commission shall have power to act upon all reports and requests from the District Forester, furnish upon requisition the number of fish plants necessary to stock streams within the national forests, provide proper facilities for transport to places of destination, and properly supervise shipment from hatchery to nearest railroad point; and shall issue proper instructions to forest officers designated to transport fish from railroad point to streams, giving at least two weeks' advance notice of date of arrival.

6. Upon recommendations from the District Forester, deputy game wardens will be appointed state fire wardens, and the Commission or its duly authorized agent will instruct such wardens to cooperate with the Forest Service in the suppression and prevention of forest fires.

7. All deputy game wardens will pay strict attention to the enforcement of state fire laws, familiarize themselves with the regulations governing the use of the national forests, and by personal actions and attitude assist in creating the right public attitude and sentiment toward these laws and regulations.

8. Deputy state game wardens will report, through the State Fish and Game Commission, any misconduct of forest officers on the dereliction of duties in the enforcement of fish and game laws.

9. The Fish and Game Commission will provide the necessary signs, labor, and material, for the proper posting and supervision of existing state game refuges or those which may hereafter be established within or adjoining the national forests.

10. Necessary expenses of forest officers in the investigation and prosecution of fish and game violations will be paid by the Fish and Game Commission upon properly certified accounts on forms furnished by the Commission.

11. Amendments to this agreement may be proposed by either party upon giving thirty days' notice to the other. Amendments shall become operative immediately after they have been adopted by both parties.

12. It is mutually understood and agreed that this agreement shall terminate at the end of any fiscal year in the event that Congress shall fail to make an appropriation for the ensuing fiscal year.

BIRD PROTECTION SOCIETIES.

Due credit must be given associations of bird lovers, such as the Audubon societies, for initiating many of the campaigns which have brought about better protection for wild birds. The National Association of Audubon Societies was the pioneer in the establishment of reservations where birds are protected the year round. The laws protecting the sale of bird plumage were also initiated by the National Audubon Association.

There are at present in the State of California two active bird organizations of this type, the California Audubon Society, with a large membership in Southern California, and the Audubon Association of the Pacific, with a membership in the San Francisco Bay region. The latter organization, which is but a few years old, has been doing some splendid work among juveniles by organizing junior Audubon societies and by stimulating bird study among the Boy Scout organizations. It is also actively carrying on an educational campaign through the medium of a small monthly periodical known as "The Gull," which is now in its second volume. Besides conveying information regarding the monthly meetings and monthly field trips, "The Gull" has contained a number of interesting articles relating to bird protection and many notes of the occurrence of rare species of birds. This latest addition to organized bird study, the Audubon Association of the Pacific, under the active leadership of its president, Mr. C. B. Lastreto, is carrying out both lines of endeavor expressed in its aims—the study and protection of birds.

GAME ABUNDANT IN EARLY DAYS.

In an article appearing in "The Auk," volume 37, page 35, entitled "In Memoriam: Lyman Belding," Dr. A. K. Fisher says of this pioneer ornithologist, in connection with the subject of the abundance of game in California in early days:

He went to Stockton in March, 1856, and of game seen here and in other parts of California he says: "Game was abundant, including elk, antelope, deer, bear, otter, quail, and waterfowl. Elk have disappeared from the interior valleys of the state excepting a drove on the Miller and Lux Ranch of forty thousand acres in the San Joaquin Valley, and these animals are being captured and distributed to various parks. The elk of this state inhabited the tule marshes mainly, though I have seen many elk horns in the Marysville Buttes, probably left there by elk which came from the marshes of Butte Creek, and I have seen hundreds, if not thousands, of elk horns on the border of the tule swamps north of Stockton. Antelope have entirely disappeared from the Sacramento and San Joaquin valleys. I saw three in the latter valley a few miles west of Princeton in the summer of 1870 and a single one in

Lower California about twenty-five miles south of Tia Juana in the spring of 1887. Deer were mostly in the mountains, with a few along the rivers where there were extensive thickets on bottom lands. They will continue to be common with proper protection."

SURE PUNISHMENT METED OUT TO VIOLATORS OF MIGRATORY BIRD TREATY ACT.

There was a time when violators of the migratory bird treaty act depended upon escaping punishment through a trial in their own county by a jury often composed of friends and acquaintances, under which procedure dismissals reached a large percentage of the number of arrests. However, this is all changed now; for since July, 1918, the power to enforce this law has been vested in the Bureau of Biological Survey, of the United States Department of Agriculture, and instead of a trial in the state court in his own county, the violator is brought into the federal court, where, removed from his sphere of local influence, he meets certain punishment. Here in California, in the district known as the "duck country" of the Sacramento Valley, composed of the counties of Yolo, Sutter, Glenn, Colusa and Butte, prior to 1918 the number of dismissals reached about sixty per cent of the number of arrests. But in that year the arrest and conviction in the federal court of four of the most persistent violators with a substantial fine of $100 each, produced a very depressing effect upon chronic violators, and the sentiment has changed to such an extent that the violator usually begs to be allowed to plead guilty in the state court rather than be taken before the federal authorities. This certainty of punishment of violators, in the "duck country" alone, resulted during the period from October 6, 1918, to January 31, 1919 (almost four months), in 20 arrests, *no* dismissals, and fines aggregating $705; and during the period from October 15, 1919, to December 6, 1919 (less than two months), in 23 arrests, *no* dismissals, and fines aggregating $625. At first glance, owing to the greater number of arrests recorded for the latter period, it might seem that violations were on the increase during 1919, but this is not necessarily true. When it is remembered that since 1918 all United States deputy wardens also became state deputies, the increase in the number of arrests can no doubt be traced to the fact that the patrol service has become greatly augmented and more violations detected.

And it is not only in California that the migratory bird treaty act is being more stringently enforced. Five hundred dollars, the maximum fine, was recently levied by a judge in Michigan against a hunter for selling thirty-two ducks in violation of the act. Another violator of the same law, in Connecticut, who had been guilty of repeated offenses, was sentenced to three months in jail. This offender was not given the alternative of paying a fine. This growth in the number of convictions and enlargement of fines through the country shows the increasing concern with which the courts regard violations of this important statute, designed to protect migratory, insectivorous and nongame birds.

NAVAL AIR STATION FISH PATROL OPENS IDLE CANNERIES.

It will be of interest to know that the fish canneries of Southern California had been idle for four months until the inauguration of the Naval Air Station Fish Patrol. This service was instituted during the latter part of December, 1919, in accordance with an agreement between the Naval Air Station at San Diego and the Fish and Game Commission, whereby seaplanes were to sight schools of fish, wire back the direct location to the naval station, which then would telephone the information to the San Diego office of the Fish and Game Commission, which office in turn would immediately notify all canners and fishermen.

As a result of the first day's radio report locating schools of sardines, fishing fleets were able to procure large quantities of sardines, and since that time have been canning continuously, despite the fact that canneries previously had been idle for four months. Everyone interested in the industry is aware that the best and finest fish are found in deep waters, and fishermen hesitate going to uncertain fields on account of loss of time. But now the seaplane locates the schools and they are no longer a prospect, but a certainty.

Genuine sardines are found only in California waters and those of Southern Europe, and the industry in California has made great progress in the past three years and bids fair to become the sardine canning center of the world. And now with the immeasurable value of the Naval Fish Patrol service a proven fact, it would seem that nothing could stand in the way of this development. And although the seaplanes have been so successful in locating schools of sardines, it is anticipated that they will be of still greater value in locating schools of large fish such as tuna, albacore, yellowtail, amberfish, etc., which are found farther from shore and run from early spring to late fall.

Reports of some of the flights made have revealed to canners the fact that seaplane service is really of as much a necessity to the fish and canning industry as fishing fleets or canning machinery, and it is the concensus of opinion that this fish patrol service must be continued. Here are a few of the reports:

I. Installed in cockpit--Hydroplane H. S. 2 L., as observer, Lieutenant E. P. McKellar, pilot. Third occupant, wireless operator. Took flight promptly 2 p.m. Followed leading hydroplane containing Lieutenant Linkins as official observer. Atmosphere fairly clear—slight haze, no clouds, sun rays direct, fairly stiff wind. Judged altitude plane our flight five to seven hundred feet. Altitude leading hydroplane considerable less. Flew north-northwest to area four, square seventy-three, which is west by north, off the coast of La Jolla about five miles and about twenty miles from San Diego by direct line. In this area of approximately ten miles square, we covered the course in serpentine fashion from south to north and return, from east to west and return. Neither on our flight to this area, nor in this area, did either crew discover a school of fish.

II. In this area, however, saw on four separate and distinct occasions, at intervals and in different locations, one single fish on each occasion. From our altitude, their depth in the water could not be definitely determined, nor could the size or species. Taking into consideration the effect of light upon and through water, the magnifying effect of clear water, the silvery scintillating sheen of fish scales on a moving object in clear water on a bright day, subtract our elevation; concluded these fish to be medium sized bass or yellowtail, although the perspective of distance made them appear in the size of a large sardine.

III. The area thoroughly patrolled, we followed the leading hydroplane east by south to the shore line above and off the coast of La Jolla. In the cove off La Jolla the leading hydroplane sighted three small schools of sardines. The information was immediately radioed to North Island, and all canneries had the benefit of this discovery within ten to twenty minutes thereafter.

IV. Still following the leading hydroplane, which was flying low, we proceeded east by south, following the shore line about one-quarter to three-quarters of a mile off shore; our altitude about 600 feet. Here we were again forcibly impressed by the discovery of the intense visibility possible from this height, to the depths under the surface of the water. The topography of the bottom of the ocean was plainly and distinctly clear to vision, as well as all plant life and formations, this being in many instances three-quarters of a mile off shore. The depth of the water we had no way of estimating, but to hazard a guess would say it was anywhere from forty to sixty feet in depth.

V. We crossed the channel and entrance to San Diego Bay, continuing flight over a great portion of Coronado Bay, where again were impressed with the intense visibility through this water, which is not nearly as clear as the pure ocean streams and currents. Regardless of its muddy and murky appearance, it was possible to see the bed of that bay for great distances. The value of this fact should immediately impress itself on one; for this bay is one of the largest and most favored feeding grounds of the sardine when in season.

VI. We proceeded, returned to our starting point at 4 p.m., elapsed time, two hours.

FACTS OF CURRENT INTEREST.

Two Italians of Thornton, San Joaquin County, were recently arrested for using a gill net on the Mokelumne River, where such fishing is illegal. These men pleaded guilty in court on January 29 and were fined $250 each by Judge Barber.

During the season of 1919, 30,836,000 fish, mostly salmon and trout, were reared and distributed from the twenty-two hatcheries and egg collecting stations operated by the California Fish and Game Commission.

State Lion Hunter Jay Bruce has been successful in reducing the number of lions in the large game refuge in Santa Barbara and Ventura counties.

Beavers have become so abundant on the Merced River near Snelling that damage to agricultural interests have resulted and special permission has been granted to the parties injured to reduce their number.

Whistling Swans (*Olor columbianus*) have again been numerous in this state the past winter (1919-20). Although frequenting the fresh waters of the interior valleys as a rule, this year they have been seen in considerable numbers in Bodega and Tomales bays and at the mouth of the Salinas River.

Of the 4500 commercial fishermen in California, 29 per cent are natives of Japan, 27 per cent are natives of the United States, and 26 per cent of Italy.

Despite the fact that the whale is a mammal and not a fish, the Board of United States General Appraisers have decided in a test case that canned whale meat is fish and is subject to duty.

Although large numbers of herring were captured in Richardson's Bay last year (1919) and canned at Pittsburg, thus far this year they have failed to appear.

The American merganser has been reported in unusual numbers at numerous places along the Californian coast. Specimens have been taken at San Diego, and large numbers seem to be wintering in certain localities in San Francisco Bay, as for instance, near San Rafael.

HATCHERY NOTES.

W. H. Shebley, Editor.

FISH DISTRIBUTION, 1919.

During the season of 1919 the operations of the Department of Fishculture were more extensive than during any previous year of the Department's activity. The actual number of fish distributed was not as great, perhaps, as during some of the past years, but the fry were given a more careful and a wider distribution than ever before.

The procedure of distribution of fish by the fish distributing cars previously has been to deliver the fish to the various applicants at the designated railroad station, and for the applicants to attend to all of the work of actually planting the fish. In a great many instances this plan resulted in more or less serious losses of fish due to the inexperience of those handling them. A plan was adopted this season whereby a trained assistant was detailed to leave the fish car at the point of delivery and assist the applicants in planting the fish. Necessarily, it was not possible for a special messenger to accompany every lot of fish planted, but an effort was made to send someone with every large consignment, where the transportation and planting of the fish was at all difficult and when the applicants were inexperienced in fish planting.

Many of the applicants, who have been receiving trout fry from the Commission for planting in different sections of the state for several years past, are experienced in the work and no assistance from this Department, in the actual planting work, is necessary. In order to carry on this work it was necessary to employ several extra messengers for the distribution cars, but it is felt that the results obtained fully justify the extra expense.

The accompanying table shows the distribution of the different species of trout fry and salmon from the various hatcheries.

It will be noted that fish were distributed from sixteen hatcheries. In addition to these hatcheries six egg collecting stations, from which no distribution of fry was made, were operated. Thus it will be seen that altogether during the season of 1919 the Department of Fishculture operated twenty-two hatcheries and egg collecting stations and distributed in the waters of California 30,836,000 fish.

Fish Distribution, Season 1919.

Hatcheries	Rainbow	Eastern Brook	Loch Leven	Black Spotted	Steelhead	Golden	Brown
Bear Lake	748,000						
Brookdale					849,000		
Clear Creek	157,000						
Domingo Springs	220,000				116,000		
Fall Creek	670,000						
Fort Seward	234,000	8,500			508,000		
Kaweah	239,500			46,000	98,000		
Mount Shasta	2,468,500	1,670,000	2,746,000	87,000	1,411,500		320,000
Mount Tallac	51,000			685,000	185,000		
Mount Whitney	1,023,000	93,000	136,000	402,000	474,000	450,000	
North Creek	810,000						
Snow Mountain					250,000		
Tahoe	98,000			351,000		234,650	
Ukiah					600,000		
Wawona	155,000				100,000		
Yosemite	191,500			99,700	96,600		
Totals	7,063,500	1,171,500	2,882,700	1,670,700	4,718,100	684,650	320,000
Grand total, trout							18,510,450
Grand total, salmon							12,326,200
Total of grand totals							30,836,650

Furthermore a great deal of construction and improvement work was undertaken at the various stations and under favorable climatic conditions, during the coming season more trout and salmon fry than has ever before been possible can be handled. This will make it possible to meet the ever growing demand for more and more fish for stocking the streams and lakes of practically every section of the state.

MOUNT SHASTA HATCHERY.

A total of 8,102,000 trout fry were distributed in streams of northern and central California from the Mount Shasta Hatchery during the season by the two fish distributing cars. The work of distributing the fish was carried on from June 23, when the first carload left the hatchery, until October 11, when the last of the fry were planted.

In addition to the propagation of trout at the Mount Shasta Hatchery, the salmon cultural operations were given careful attention this season. The take of quinnat salmon eggs at the United States Bureau of Fisheries stations at Mill Creek and Battle Creek was not as large as had been expected, and therefore as great a number of eggs as usual was not received. The take of eggs at our own Klamathon egg collecting station, located on the Klamath River, was also small. Especial attention was given the fry resulting from the eggs received. The fish were fed and held in the hatching boxes as long as it was possible to give them the proper attention and 6,593,000 were then planted in the upper reaches of the tributaries of the Sacramento River in the vicinity of Sisson, from February 28 to May 13, as conditions for their liberation were favorable.

Three and one-half million salmon fry were then transferred to our three large salmon rearing lakes where they were retained throughout the summer. They developed rapidly under the favorable conditions obtaining therein and when they were liberated, during the latter part of October, they were in perfect condition to commence their long journey to the sea.

Since the construction of hatchery A, the main building at the Mount Shasta Hatchery, in 1909-10, the hatchery troughs have never been renewed. Many of them were in very poor condition, and it was deemed absolutely essential, that the old boxes be removed and new ones put in. Accordingly the materials were ordered and on the ground by the time the last of the fish were taken out and the construction and installation of the new troughs was immediately commenced. The crew has been engaged in this work practically all winter and by the begin-

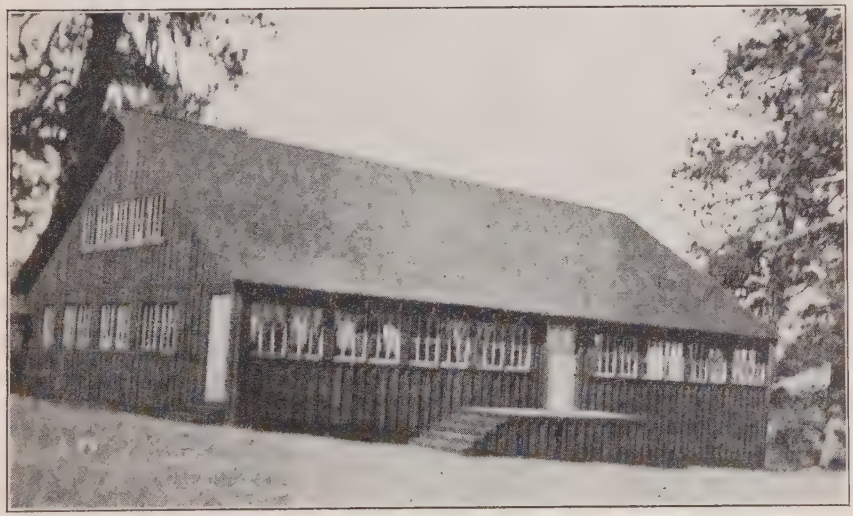

FIG. 26. Bear Lake Hatchery, San Bernardino County, California. Photographed by M. K. Spaulding, November, 1919.

ning of the 1920 fish cultural season the new troughs will be ready for the reception of the eggs. Various other repairs to buildings and grounds have been made during the fall and winter months, and all is in readiness for the beginning of the season's operations.

KLAMATHON STATION.

During the late summer of 1918 the Klamathon egg collecting station was taken over by the California Fish and Game Commission from the United States Bureau of Fisheries and arrangements were made to operate the station that fall. Over one million eggs were taken and these were immediately shipped to the new Fall Creek Hatchery.

During the fall of 1919 this station was prepared to operate at full capacity. Nearly five million eggs were taken despite the extreme drought, which materially affected the run of quinnat salmon in the Klamath River. Had we received the usual amount of rainfall in that section during the months of October and November, the take of eggs would have been greatly in excess of the number obtained. The eggs were transferred immediately after spawning to Mount Shasta and Fall Creek hatcheries.

FALL CREEK HATCHERY.

Fall Creek Hatchery was operated for the first time during the season of 1919. The quinnat salmon eggs received from the Klamathon Station were hatched and reared to a suitable age, when 500,000 were distributed in Fall Creek, a tributary of the Klamath River, during the month of May. The balance of 650,000 were held in the rearing ponds throughout the summer and distributed during the months of September and October. These fish, like the ones retained in the salmon lakes at the Mount Shasta Hatchery, were in excellent condition when planted.

BOGUS CREEK STATION.

All of the rainbow trout eggs taken at Bogus and Camp creeks were "eyed" at the Fall Creek Hatchery. Seven hundred thousand were hatched at this station and reared for distribution in tributaries of the Klamath River, both above and below the dam of the California Oregon Power Company, at Copco. The balance of the "eyed" eggs were shipped to the Mount Shasta Hatchery.

COTTONWOOD CREEK STATION.

During the spring of 1919 the Cottonwood Creek egg collecting station near Hornbrook was operated and an extensive survey made of the creek with reference to the run of rainbow trout ascending the stream to spawn, with the idea of installing more suitable and permanent equipment for egg collecting operations. The investigations and the result of the season's operations demonstrated the value of the site, and accordingly a suitable lease was arranged and adequate facilities for handling the spawning trout during the coming spring installed.

MOUNT WHITNEY HATCHERY.

The operations at Mount Whitney Hatchery for the season were brought to a close during the latter part of October. On September the first, fish distribution car No. 01, was detached from fish distributing work at the Mount Shasta Hatchery and commenced the distribution from Mount Whitney Hatchery. The waters of Southern California were practically all stocked from the Mount Whitney Hatchery this season. Consignments of fish were shipped to Fresno, Inyo, Kern, Los Angeles, Madera, Mariposa, Mono, Riverside, San Diego, San Luis Obispo, Santa Barbara, Tulare and Ventura counties. This was the most extensive distribution ever made from the Mount Whitney Hatchery.

Cottonwood Lakes station was operated and a new record was established for that station, 965,000 golden trout eggs being taken. All of the eggs were immediately transported by pack train over the mountain passes to the Mount Whitney Hatchery as soon as they were spawned, where they were "eyed." A large consignment of the "eyed" eggs was shipped to the Tahoe Hatchery and the balance were hatched and reared for distribution in the streams and lakes of the High Sierras, which were suitable for them.

Two and one-half million trout fry were distributed from Mount Whitney Hatchery this season. All of the fry planted were fine, large fish and the

results of the season's planting to the waters of southern California should be productive of some excellent fishing for the sportsmen during the coming year.

TAHOE HATCHERY.

The hatchery at Tahoe City received shipments of rainbow, black-spotted and golden trout eggs from the various egg collecting stations and a total of over 650,000 fry, of these three species, were distributed in the water of the Tahoe Basin and other streams of El Dorado, Nevada and Sierra counties. During the month of October a consignment of 25,000 golden trout fry were shipped to the Yosemite Valley from Tahoe Hatchery.

MOUNT TALLAC HATCHERY.

The egg collecting operations at Mount Tallac Hatchery last spring were not as successful as usual, owing to adverse conditions of weather at Lake Tahoe during the early spring months. The crew reached the spawning station during the middle of March, but it was April 14th before the first eggs were taken. Two million black-spotted trout eggs were taken during the season and these were "eyed" and shipments of eggs were sent to Mount Shasta, Mount Whitney, Tahoe, Kaweah and Yosemite hatcheries. Nearly 700,000 black-spotted eggs were hatched at the Mount Tallac Hatchery and were distributed together with rainbow and steelhead trout fry in the waters of Alpine, El Dorado and Placer counties.

FORT SEWARD HATCHERY.

A million quinnat salmon eggs were hatched at Fort Seward Hatchery during the spring of 1919 and the resulting fry were distributed in the Eel River and tributaries, Mad River and the tributaries of Humboldt Bay. Rainbow, eastern brook and steelhead trout eggs were shipped to the Fort Seward Hatchery during April and May and these were hatched and reared during the spring and early summer months. A total of 770,000 trout fry were distributed in the streams of Humboldt and Trinity counties during July and August.

As soon as the fry were distributed extensive improvement work at the station was commenced. The site of the hatchery is very isolated and great difficulty has been experienced in keeping assistants employed at the station. The living quarters for the men have been very poor and it was essential that something be done to improve conditions, if the station was to be kept in operation. Accordingly arrangements were made to improve the superintendent's dwelling and two plain, but comfortable, little cottages were put up for the assistants and equipped with necessary furniture for housekeeping.

UKIAH HATCHERY.

A larger number of steelhead trout fry were reared at Ukiah Hatchery for distribution in the streams of that section than have been handled during former seasons. A total of 600,000 trout fry were distributed in Mendocino and Sonoma counties during the summer. In the spring months practically all of the eggs taken at Snow Mountain Station were "eyed" at Ukiah and the results obtained were very satisfactory.

SNOW MOUNTAIN STATION.

During the spring of 1919, 5,400,000 steelhead trout eggs were collected at the Snow Mountain Station. Had it not been for the failure of the water supply and inadequate facilities for handling spawning trout in the holding pens in the late spring, when the water became very warm, a much greater number of eggs could have been taken. A quarter of a million steelhead eggs were hatched at the Snow Mountain Station and distributed in the tributaries of Eel River. During the past month a crew of men at the Snow Mountain Station have been engaged in building new holding pens and making improvements and repairs to the station, that will improve the handling of the fish during the coming season.

BROOKDALE HATCHERY.

Brookdale Hatchery was operated the same as usual during the season of 1919, the steelhead eggs received from Scott Creek being "eyed" for shipment to other stations, with the exception of 850,000 fry, which were hatched and planted during the summer months in Monterey, San Mateo, Santa Clara and Santa Cruz counties.

SCOTT CREEK STATION.

The total take of steelhead trout eggs was only 1,750,000 at Scott Creek during the season of 1919, owing to the drought, which seriously interfered with the extent of our operations in that section. As stated above the eggs were all sent to the Brookdale Hatchery, where they were "eyed" for distribution to various other hatcheries.

ALMANOR HATCHERY.

Two hundred thousand rainbow trout eggs were taken at the Almanor dam of the Great Western Power Company last season, but the water supply for the hatchery failed early in the season and it was necessary to transfer all of the eggs as soon as they were properly "eyed" to the Clear Creek Hatchery near Westwood.

DOMINGO SPRINGS HATCHERY.

Nearly a million rainbow trout eggs were taken at Domingo Springs Station during the season and consignments of "eyed" eggs were shipped to Mount Shasta and Wawona hatcheries. The rainbow and steelhead trout fry reared at the Domingo Springs Station were given a very wide distribution in streams and lakes of Lassen, Plumas and Tehama counties. An auto truck was used for a great part of the distribution and the United States Forest Service at Mineral cooperated in the work of giving the fish a wide distribution. After the fish were all planted very extensive improvements were made to the station and an auxiliary egg collecting station was established at the mouth of Warner Creek If conditions are favorable during the coming season for egg collecting operations in that section, a much larger take of eggs can be looked for than has ever before been obtained.

CLEAR CREEK HATCHERY.

The rainbow trout eggs received at Clear Creek Hatchery from the Almanor Hatchery were hatched and distributed in the streams and lakes in the vicinity of Westwood, Lassen County. It was the first season this station was operated and the results obtained were satisfactory in every respect. After the fish had all been distributed many little repairs and improvements were made and racks and trap were installed in the creek beside the hatchery. A holding pen for the spawning trout was also constructed and during the coming season an effort will be made to collect eggs from the rainbow trout running up Clear Creek to spawn.

FIG. 27. Fish rack on Warner Creek, Plumas County, California, where many trout were taken for spawning purposes this past year. Photographed by M. K. Spaulding, September, 1919.

BEAR LAKE HATCHERY.

Nearly 5,000,000 rainbow trout eggs were taken at North Creek Egg Collecting Station during the season of 1919, despite the inadequate facilities to handle the work. It was demonstrated that to take advantage of the wonderful possibilities for the collecting of rainbow trout eggs at Bear Lake it was essential that very extensive improvements be made in order to handle the spawning fish properly, that suitable hatchery buildings, properly equipped, be provided at both North Creek and Green Spot Springs, and most important of all, that adequate living accommodations be provided for the foremen and assistants at both places. It is not possible to obtain satisfactory results from a station where the egg collecting paraphernalia is inadequate for the requirements, and poorly constructed; where the hatching troughs are covered only by canvas and where the foremen and assistants in charge of the work are compelled to live at an altitude of 7000 feet above sea level, in a land of deep snow and freezing weather, with only small tents for living quarters. It is neither fair to the men nor to the work to operate under such conditions. Accordingly, as soon as the fish were distributed, a crew of men was put to work on the various creeks flowing into Bear Lake. The beds of the streams were cleaned up and passageways were cut to enable the spawning fish to enter the creeks through the sand bars. Checks were made, racks and traps constructed, and cabins built for watchmen and trap tenders.

The hatchery buildings at North Creek and Green Spot Springs were put in first class shape and suitable living quarters were constructed for the foremen and assistants. The stations are now in excellent condition for the coming season's work, and if there is sufficient snow and rainfall in that section this season, the take of eggs will undoubtedly break all past records.

KAWEAH HATCHERY.

To keep up with the demands of the applicants of Kern, Fresno and Tulare counties for trout fry for the streams of that section, it was decided to establish an experimental hatchery to ascertain the suitability of the water for hatchery purposes. A site was selected near the town of Hammond on the Kaweah River, on one of the main highways. Rainbow, black-spotted and steelhead trout eggs were shipped to the hatchery and the fry hatched were given the very best attention throughout the spring and summer months, careful records being made of water temperatures. The fry reared were strong and healthy and attained a very good size. Three hundred and eighty thousand trout were hatched, reared and planted in the tributaries of the Kaweah River and other streams in that section during the summer. All arrangements have been made and plans drawn for a good-sized hatchery building to be constructed this spring, providing that a satisfactory lease can be obtained for a hatchery site.

WAWONA HATCHERY.

Wawona Hatchery was again operated during the past season. Rainbow and steelhead eggs were shipped in from other stations and a quarter of a million fry were distributed in the streams of Madera and Mariposa counties during the early summer months.

YOSEMITE HATCHERY.

The experimental station located at Happy Isles in Yosemite Valley was operated during the summer. Rainbow, black-spotted and steelhead trout eggs were shipped in from other stations, and the fry resulting therefrom were successfully reared to a good size and were given an extensive distribution in the streams and lakes in the Yosemite Valley, with the cooperation of the officials and employees of the Yosemite National Park. The site was demonstrated as being satisfactory for hatchery purpose, but as it is against the policy of the state to erect permanent buildings on leased land it was decided at a meeting of the Board of Fish and Game Commissioners, held during the latter part of October, to abandon the project. All equipment was therefore removed from the site and transported by auto trucks to the Wawona Hatchery, where it has been used to equip that station for more extensive operations.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor

INVESTIGATION OF HALIBUT FISHERIES PROPOSED.

In the proposed treaty between the United States and Canada to regulate and conserve the halibut fishery it is provided that inhabitants of either of the two countries may not fish for halibut in the North Pacific Ocean from November 16 to February 15, both dates inclusive, this closed season to continue in effect until February 15, 1930. It also provides that the two governments shall cause to be made a thorough joint investigation into the life history of the Pacific halibut. The International Fisheries Commission, appointed by the two governments in 1919 for the protection and rehabilitation of the salmon fisheries of the Fraser River and Puget Sound, is charged with the supervision of the halibut investigation.

It was conclusively shown some six years ago by Mr. W. F. Thompson, who made an investigation of the halibut fishery for the government of British Columbia, that the known halibut banks were being depleted at an alarming rate. This was clearly shown by a decided decrease in the catch per unit of fishing gear and by a marked reduction in the catch of large fish. Since that time the total catch has declined rapidly and it does not need a life history investigation to show that the halibut fishery of the North Pacific is well on its way to commercial extermination. An investigation of life histories is well enough and a necessary part of such an investigation, but it is more important to institute a system of gathering accurate statistics of the catch. We have been slow in learning that the basis of fisheries conservation work must be accurate and complete data of the catch. It strikes us that the two governments are about six years late in starting and that the short winter closed season, during the time the catch is always very light, is totally inadequate.

SLEEPER SHARK CAPTURED.

A sleeper shark, known to ichthyologists as *Somniosus microcephalous* was taken in one of the A. Paladini Company's trawl nets while fishing off Point Reyes on February 26. The length of the fish was only seven feet, which is considered small, as sleeper sharks reach a length of twenty-five feet. The event was not remarkable in the fact that a shark was taken in a trawl net, for the trawl nets catch large numbers of sharks, but in the fact that this is the first sleeper shark that has ever been recorded from California. This adds one more species to the list of nineteen sharks found in California as given by Professor E. C. Starks in October, 1917, and January, 1918, issues of this magazine.

The sleeper shark may be known from the other sharks by the absence of an anal fin and by the absence of a spine at the front of each of the two dorsal fins. This sluggish and clumsy looking shark is commonly found in the Arctic regions and extending down the Siberian coast to Japan and down the west coast of North America to Puget Sound. It is found commonly about Greenland and south to Cape Cod and France. On our New England coast it is known as the gurry shark from its habit of eating fish offal. In Alaska it frequents the region of the salmon canneries where it eats the fish offal thrown away at the canneries. It is reported as attacking whales in a ferocious manner, biting chunks from their hides.

MARKING SOCKEYE SALMON FRY.

The United States Bureau of Fisheries is marking yearling sockeye salmon fry at their Bonneville Hatchery in Oregon. These fry, hatched from eggs obtained at the salmon hatchery at Afognak, Alaska, will be liberated in the Columbia River and a watch kept for their return to the stream to spawn three years hence. A few years ago the Bureau marked and liberated, in the Columbia River, sockeye fry which were hatched from eggs taken at Yes Bay, Alaska. These fry returned at the age of four years to spawn and it was found that they were not like the sockeyes which run naturally in the Columbia River but were like the Yes Bay fish in size and quality, thus proving pretty conclusively that the fish from the

two places are not different on account of a difference in the feed in the two places, but for the reason that the sockeyes of the two regions are distinct races and that size and quality are inherited characters. The sockeyes at Afognak are of still another race whose members are smaller of size and of different quality when compared with either the Yes Bay or Columbia fish of the same species. The return of the fish now being marked will be eagerly awaited for the final and conclusive proof that size and quality are inherited characters.

LOW RIVERS INFLUENCE SPAWNING HABITS OF HERRING.

Ordinarily herring which enter San Francisco Harbor in January and February congregate in Richardson Bay and along the lower end of Angel Island, attaching their spawn to the rocks and sea weeds along the shores of Belvedere as well as along the shore of the main land and Angel Island near the lower end of Raccoon Straits. This year, on account of the low water in the rivers, which permitted the salt water to move further up stream than ever before recorded, the herring have for the first time in the memory of the oldest fishermen, deposited their spawn in the upper portion of the harbor known as San Pablo Bay. They attached their sqawn in all suitable places from Point San Pablo to Point Pinole and the schools of herring instead of collecting in Richardson Bay near Sausalito and Belvedere moved on up through Raccoon Straits so that the best fishing was found from Southhampton Shoal to Red Rock.

Very few herring were caught this season in San Francisco Bay for the reason that there was no good demand for them in the markets and under the new law the fishermen were not permitted to catch them for reduction purposes. The San Francisco wholesale markets were not able to dispose of over two or three tons per day. None were salted or smoked as the local demand for salted and smoked herring ended when the saloons closed on July 1. The market for canned herring was off so none of them were canned. Fishermen at the wharf frequently begged for buyers at twenty-five cents per box, and these delicious fish were offered at the fish stalls at from five to seven cents per pound without creating any appreciable demand among those who complain of the high cost of fish. Salmon and striped bass were scarce at the time and extremely high priced, but even that did not help the sale of the cheaper variety.

SALMON PACKERS FEAR SALMON DEPLETION.

With the failure of the sockeye runs in Puget Sound and Fraser River as an object lesson the salmon packers have become alarmed over the future of the salmon industry in Alaska. The interested packers met together and decided something had to be done if the Alaska salmon fisheries are to continue yielding them a profit. A committee was appointed to draft a comprehensive bill for the conservation of the fisheries to be introduced and passed upon by the Congress of the United States. The committee was wisely chosen and is made up of the following members: D. W. Branch of Libby, McNeill & Libby; Carl A. Sutter of the Fidalgo Island Packing Company; Frank M. Warren of Alaska-Portland Packers' Association; Henry O'Malley, Pacific Coast Agent United States Bureau of Fisheries; Dr. C. H. Gilbert of Stanford University; John N. Cobb, Director College of Fisheries, University of Washington; John R. Beegle, of Alaska Fish Commission, and C. D. Garfield, Secretary Alaska Fish Commission. The committee has worked for several months and has finally perfected a bill which is likely to have the backing of the salmon packers, the Alaska Fish Commission, the United States Bureau of Fisheries and all interested in salmon conservation. The main object of the bill is to provide for a larger number of salmon to reach the spawning beds. It also provides for the organization of an Alaska Fish Commission composed of five members to be appointed by the Secretary of Commerce and gives this commission ample power to carry on the conservation work of such a commission. It is estimated that the measures in the bill regulating the fishing seasons and methods of fishing will reduce the salmon catch about twenty per cent.

KAMABOKO BEING MANUFACTURED AT SAN PEDRO.

Among the additions to the fish packing industry at San Pedro Harbor is a plant recently established by Mr. Isona for manufacturing kamaboko. This is a product prepared from white-meated fish by Japanese methods. Barracuda is usually employed in its manufacture but halibut, sea bass and jewfish are sometimes utilized.

Kamaboko is prepared by first removing all bones from the fish and scraping the flesh free from the skin. The meat is then placed in a large, hollow granite bowl where it is ground into a fine paste. Cornstarch, salt, sugar, and the juice made by soaking several fronds of Japanese seaweed (*Arthrothamnus bifidus*) in warm water are added, and the mixture is then moulded into forms and placed on thin wooden blocks about eight inches long. After being steamed for forty-five minutes it is cooled and packed for shipment. For fetes and special occasions the loaves, weighing about one pound, are tinted, red, blue, or green, and resemble very much pieces of pastry. Other forms are moulded and baked or fried in oil without coloring.

The manufacture of kamaboko has developed into quite an industry in Japan, where it is one of the staple articles of food. It is palatable and nutritious and may be eaten as a sandwich filling, or cut into small pieces and added to soups, chowders, or chop suey. The finished product will keep about one week, but plans are now under way to can it for export trade.

The plant at San Pedro has a capacity of approximately five hundred pounds of fish per day. C. S. Bauder.

Most of those who complain of the high cost of fish know only three varieties—salmon, striped bass and halibut.

* * *

Any official who attempts to satisfy the public on the price of fish has set for himself an impossible task.

* * *

Scarcely one-fifth of California's fish catch goes to the fresh fish markets.

* * *

The wholesale value of last year's fish pack in California exceeded twenty-five million dollars.

* * *

California ranks first among the states in the value of her fishery products.

* * *

If California had depended only on the fresh fish markets its fisheries would now be unimportant.

* * *

The only adequate way to get the public to eat new varieties of fish is to get the fish in cans and give them euphonious names.

* * *

The price of fish does not cut as much figure as the name.

* * *

One of the best food fishes we have in California is the shad, which was introduced some fifty years ago from the Atlantic coast. These excellent fish are now running and are abundant and cheap. We will use less than ten per cent of the catch in this state. The rest will be shipped to Chicago, Boston or New York where they sell readily at three times their price in San Francisco, while we continue to complain of the high cost of fish.

NOTES FROM THE STATE FISHERIES LABORATORY.*

By Will F. Thompson and Elmer Higgins.

A SCIENTIFIC ASSISTANT EMPLOYED.

The Commission has secured the services of Miss Helen M. Edwards as a scientific assistant, commencing January 15. Miss Edwards has had considerable experience as assistant in work of the character now being done by the Commission, having been employed while she was still an undergraduate at Stanford University, by Doctor C. H. Gilbert during his work on the salmon. In addition, she has done scientific drawing, and is a capable stenographer.

W. F. T.

PROGRESS OF THE SARDINE WORK.

Mr. Higgins at San Pedro, and Mr. Sette at Monterey, are engaged under the supervision of Mr. Thompson, in laying the foundation for the future work on the sardine. This preliminary "survey," if such it may be called, consists of a careful and laborious tracing of the character of the sardine "runs" at different times of the year and the ascertaining of the size classes which go to make up the catches. The samples are obtained from the boats as they unload at the canneries, and measurements of length and weight are taken, together with other biological observations on sex and state of maturity. This is expected to give data upon which age may be distinguished, to render it possible to correlate fluctuations in catch with various conditions, to enable the catches of successive years to be compared more accurately from the standpoint of age composition and to indicate the spawning season as nearly as possible. The necessity for such a "survey" and its value in future work have already been amply demonstrated in a number of ways, upon which comment may be expected in the future.

The Commission has been granted the courtesy of accommodations at Hopkins Marine Station, at Pacific Grove, as headquarters for the work being done on the sardine at Monterey, and thanks are due the director, Doctor W. K. Fisher, for his many favors. The work on the sardine is also being carried on at San Pedro, and the Commission is under obligations to the Neilsen and Kittle Canning Company for quarters there. Without their courtesy the Commission would be without adequate facilities for the investigation, as the present laboratory at Long Beach is too distant from the fishery centers.

W. F. T.

*California State Fisheries Laboratory, Contribution No. 18.

OCCURRENCE OF A DEEP SEA FISH AT MONTEREY.

It often happens, especially in deep sea halibut fishing, that cod or halibut trawls are set over water which is too deep, and in such case strange silvery fish are sometimes taken. These fish have snouts projecting in sharp angles beyond the large mouth, their eyes are large, their scales are very rough and silvery, and the body tapers back into a long, thin, pointed tail bordered above and below with fins, but lacking a separate tail fin. These fishes are allied to the cods, and belong to the family Coryphaenoididae. One such specimen was brought into Monterey during January, and preserved by Mr. Oyer, the deputy there. It belongs to the species known as *Nematonurus acrolepis*, one taken in numbers by the United States Bureau of Fisheries' vessel "Albatross" during her work off California, and found along our coasts in depths of 500 and 1500 fathoms as far north as Bering Sea and in Japanese waters. It was entirely unknown to the fishermen, as would be natural considering the depths at which it is usually found.

W. F. T.

INVESTIGATION OF THE SALTON SEA.

During the latter part of December, Mr. Crandall of the Scripps Institution, and Doctor H. C. Bryant and Mr. W. F. Thompson of the Fish and Game Commission, visited Salton Sea to investigate the life and the hydrographical conditions of the sea. They were the guests of Captain Davis, who has long been known to the Commission as engaged in shipping mullet from Salton Sea. During the visit, large specimens of mullet were taken by Captain Davis' fishermen, but no other

live fish were observed with the exception of two top minnows taken along the shore. These were of a form usually taken in desert springs and streams, *Cyprinodon macularius*. Later Captain Davis sent to Mr. Thompson samples of small fish taken from the vicinity of Fish Springs at the northwestern end of Salton Sea. These proved to be of the same species.

The existence of the grey mullet in Salton Sea is of considerable interest, as the species must have entered during the inflow of the Colorado River during 1906. If so the mullet must have lived in the Colorado at some distance from its mouth, a fact not strange when the frequent appearance of the mullet in rivers and lagoons bordering our coast is remembered. However, it has taken some time for the species to become abundant in Salton Sea, it having been unrecorded previous to 1915, according to Captain Davis. During the interval it is said that carp appeared in great numbers and then died off. The carp and the mullet are both bottom feeding fish, consuming vegetation, etc., and are not dependent on other smaller fish species. But the mullet is also capable of existing in brackish and salt water—that being its natural habitat in fact—and it is probable that this enabled it to flourish where the carp could not. The ancients used to grow mullet in artificial enclosures, and the flesh was considered a great delicacy.

There are also said to be species of fresh water fish found at times near the outlets of the New and the Alamo rivers, but nothing was seen of these. W. F. T.

THE RECUPERATIVE POWER OF THE ABALONE.

During 1911 Mr. W. F. Thompson carried on a survey of the shell fish of the northern part of the state, and during its course came naturally to handle many specimens of the red abalone, *Haliotis rufescens*. Among these was a specimen remarkable for the evident great recuperative powers. The viscera of the abalone naturally surround the large central muscle in a peculiar way, as a bent cone, and in this case the cone had been cut off by some one attempting to obtain the abalone. The attempt failing, the abalone had evidently succeeded in covering the large mass of dead cut-off parts with pearly layers of shell. But that the animal had been seriously injured could not be doubted, the edge of the shell showing a total cessation of growth for some time previous to death. The shell only was found, the abalone having finally died, possibly as a result of the injury. A photograph of it is presented.

Altered shell formation is not at all infrequent, particularly among clams, where growth is often seemingly totally stopped by some injury, and starts again well in from the former edge. But no instance has ever been seen by the

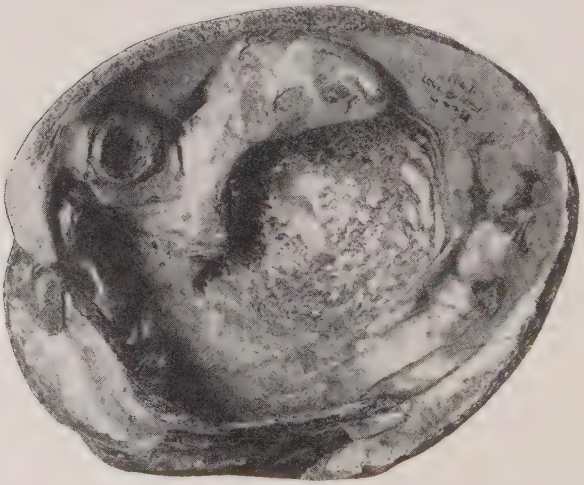

FIG. 28. Shell of abalone (*Haliotis rufescens*) showing part of damaged viscera covered by a pearly layer of shell. Taken near Fort Bragg in 1911.

undersigned where the injury was of such a severe nature as in the case of this abalone, and in which shell formation subsequently proceeded for any length of time. W. F. T.

OCCURRENCE OF THE GREEN ABALONE IN MONTEREY.

Due to the kindness of Mr. Ernest Dalter, who conducts a sea food restaurant in Monterey, it is possible to record the occurrence of the northern "green" abalone, *Haliotis wallalensis*, in the Bay of Monterey. It is undoubtedly a very rare inhabitant of our waters. Mr. Dalter has in his possession a shell of this supposed variety of *Haliotis fulgens* 3¾ inches long. It is hardly to be doubted that it is a distinct species, not a variety of the "green" abalone, the shell much resembling that of the red abalone, never exceeding 5½ inches in length, and usually possessing 6 or 7 open holes. W. F. T.

STREAM POLLUTION IN NEW YORK STATE.

In a recent publication by the Conservation Commission of the State of New York, 1919, Doctor Henry B. Ward of the University of Illinois records the results of his preliminary investigation of polluted streams in New York in their relation to fish life. In this paper he emphasizes the utility of biological work, rather than chemical or bacteriological, in determining the extent of pollution. Bacterial tests are made to determine the effect of the water when used for drinking, but these have little relation to fish life. Chemical tests are of limited use because "we do not by any means always know the effect upon living organisms of a given chemical substance," especially in varying dilutions and relation to other chemicals present. "In order to reach a more accurate measure of the injurious character of polluted waters, one would have to take into account the effects of the prolonged influences of a waste on the fish." The resistance of various species varies widely, as does that of the same species at different seasons. Doctor Ward is plainly of the opinion that "if the character of the water and the bottom have been so modified by the introduction of foreign materials that they no longer afford opportunity for the development of these smaller organisms (food for fish), then by the absence of such forms of life one would demonstrate clearly and positively the fact that water has been rendered unfit for fish existence"—this method to be used, of course, in addition to the observations and tests made directly upon fish themselves.

Californians should be interested chiefly on account of the relation of pollution to salmon and other anadromous fishes, to which the following by Doctor Ward may sometime apply here: "It is hardly a profitable business for the state to raise at such a considerable expense quantities of young fish in order to plant them out in waters in which the chances of existence are unfavorable." Doctor Ward presents a preliminary survey of the water polluted streams, and a series of recommendations, to which the attention of any one interested may be called. He lays much emphasis on the necessity of a careful census, continued study, reclamation of wastes and the education of public opinion to the banishment of wastes from our streams as they have been banished from our streets. There is enclosed with the paper a map showing the great number of establishments in New York from which pollution may be expected.

W. F. T.

GULLS IN MONTEREY BAY.

On account of the fish eating habits of sea gulls, their abundance is a matter of interest to those engaged in the study of fish. At Monterey, where the sardine canneries are located, there are frequently great flocks at rest on the rocks and adjacent quiet waters, which seem to be thickly spotted with the birds as far as the eye can reach. An exceptionally favorable opportunity seemed to present itself on February 17 of this year, 1920, because of the unusual number of birds present, and an attempt was made to estimate the numbers of birds within eyesight of a window in the Hopkins Marine Station. Counting with a field glass it was certain that 3000 were within sight of the naked eye, and it would not be amiss to increase this by another thousand to cover those not seen or in flight. This number, 4000, surely represented a half of the total in the region comprising the waterfronts of Monterey and New Mon-

terey. (Later in the afternoon Mr. Sette counted 2000 from the same position, thus virtually corroborating the previous estimate.)

According to Doctor W. K. Fisher the species dominantly represented were the glaucus-winged, the western, and the herring gulls, in the order named.

There can not be much doubt as to the fact that the birds in Monterey Bay were the majority of those within many miles, and many more than are usually present, so that from the rough figures given some estimate of the maximum amount of fish they might consume can be derived. Taking a pound of sardines a day as all a sea gull would consume, an estimate probably very excessive, and considering them all as fish eaters, the four thousand within sight would be satisfied with two tons. This would be about six-tenths of one per cent of what are taken daily by fishermen at this point. Furthermore it is almost certain that most of the fish eaten by the gulls are the sardines discarded by the boats and canneries, or other species locally abundant. Doctor Fisher calls attention to the fact that gulls are diurnal in habit, and must have trouble in catching live sardines during the light of the day, the more so as they are incapable of diving more than a few inches under the water surface. Naturally, regardless of the exact proportion the gulls in sight were of the grand total, the amount eaten is not one which threatens to deplete the sardine. And as a matter of fact, the presence of so many gulls should be rather a sharp commentary on the waste during the handling of the fish.

These remarkably large flocks of gulls which obtain their food from the sardine industry are supposed to stay at night on some rocky islets at some distance from the canneries, but Mr. Sette who has collected samples of the sardine catch throughout this season, states that he has observed gulls to the number of thirty or more feeding on the sardines lost overboard from lighters unloading about 11:30 at night, hence during total darkness, on January 20 of this year. Whether this is a normal or usual habit with them he does not know. W F. T.

OCCURRENCE OF A RARE CRAB.

Mr. T. Taniguchi, one of the Japanese fishery experts at one time engaged in the albacore fishery for the Fish and Game Commission, has forwarded three crabs taken from a depth of twenty-five fathoms on a rock cod bank about half way between San Diego and the Coronado Islands. They prove to be very interesting specimens of the same species as one taken by the United States vessel, the "Albatross," during her deep sea work on this coast in 1889 at Station 2946, latitude 33 degrees 58 minutes north and longitude 119 degrees 30 minutes 45 seconds west, and described by James E. Benedict as *Galathea californiensis*. The correspondence between our specimens and the one described by him is very close, and no doubt exists concerning the identification.

The present specimens were taken by the boat "Julia," engaged in rock cod fishing, and were inside a silicious sponge, one of the open Hexactinellid type, about three feet in diameter. They were taken February 5, 1920. The largest is 50 millimeters in length from the telson to the tip of the rostrum. W. F. T.

SCIENTIFIC WORK OF THE "ALBACORE" IN DECEMBER.

Early in December of last year, the "Albacore" made its final trip of the season for the collection of data on the life history of the halibut. During the greater part of last year, trips were made at regular intervals for the purpose of collecting data on the distribution of the eggs and young of food fishes and the location of their spawning grounds, as well as the collecting of data on the life history of the halibut, but owing to insufficient equipment a part of this work was discontinued, and now all of it is temporarily stopped, due, in part, to the centering of the attention of the laboratory staff on other and more pressing problems. The results of the December trip are of special interest because they illustrate both the practical or immediate, and the more purely scientific values of such work.

In hauling for flatfish, a special otter trawl modified from the commercial

paranzella or drag net is used, with ordinary manila rope towing warps. This gear is simple and crude, but catches are made averaging from 500 to 1500 pounds of fish and invertebrate animals, including as high as twenty species of fish in one haul. Although the work has been chiefly confined to inshore operations, on December 9 and 10 two hauls, which yielded valuable results, were made in water about 50 fathoms deep on a good trawling bottom off Huntington Beach, Orange County.

Besides taking a commercially successful catch of market fish, red rock cod (*Sebastodes sp.*) halibut, flounders, and sole of various species—these hauls revealed the presence of several species of excellent food fishes not commonly taken in these waters and rare or unknown in the markets. One of these was the sand dab, *Citharichthys sordidus*, so common in the San Francisco markets. These fish are not caught in any quantity in the south, and the southern markets therefore receive their supply from the north.

Another species taken in considerable quantities in the hauls was the yellow-spotted sanddab, *Citharichthys xanthostigma*, recorded for the first time from the California coast in CALIFORNIA FISH AND GAME for April, 1919. This sand dab is a wider, plumper fish, with more meat for the amount of bone than the common dab from San Francisco and would be more valuable if the location of profitable banks were known and a stable supply in the markets insured.

Two species of "sole" were also taken which might be found in commercial quantities in the south if they were sought in deep enough water. These were the slippery or Chinese sole, *Microstomus pacificus*, and the long-finned or rex sole, *Glyptocephalus zachirus*. Both are common in the San Francisco markets where they are often strung with sand dabs in bunches and all sold together under one name, but are unknown in local catches in the south.

Another species taken in these hauls was the sable fish, or Alaska black cod, *Anoplopoma fimbria*. This fish is common north of San Francisco, but is said by naturalists to be rare in southern California and seldom seen in the markets. It is, however, by no means uncommon in the south but is so little appreciated that it is grossly misnamed "hake" by the rock cod fishermen, who take considerable numbers on their lines, but reject it from the catch as worthless because the flesh is rather soft. The United States Bureau of Fisheries has advocated the exploitation of this fish in northern waters, and methods for its use have been devised. It is said to be particularly adapted to salting and drying.

Thus we see that several useful food fish have been added to the list of edible fish taken by the "Albacore" by changing the method of fishing and the locality fished, and it would seem from this that great good could be accomplished by further prospecting and experimenting in deeper water.

Of no less importance than the results recorded above are those of greater scientific interest. Besides supplying data from about 300 halibut concerning their age and rate of growth, their spawning period, and fecundity, several species were taken which extend somewhat the known range of the species, adding to our knowledge of their geographical distribution.

One of the surprising finds was the rare and little known smelt, *Argentina sialis*, Gilbert. This little fish, about three inches long, is our only southern California representative of the family Argentinidae, or true smelts, but is not related to the "smelts" common in the south, which belong to a different family. About 300 specimens were taken and they agree in all essential points with the description of the type specimen, which is the only specimen of this species known. This type specimen was recorded and described by Doctor Gilbert in 1890 as from the Gulf of California, Albatross Station No. 3017, latitude 29 degrees 54 minutes 30 seconds north, and longitude 113 degrees 01 minutes 00 seconds west, in 58 fathoms.* Our specimens were taken December 9 and 10, 1919, in 45 fathoms off Huntington Beach, and this seems to be their second recorded occurrence.

Two specimens of the peculiar little eel-pout, *Lycodopsis pacificus* (Collet), family, Zoarcidae, occurred in one of the

*Proceedings U. S. National Museum, 1890, p. 56.

above hauls. These were immature specimens and differed somewhat in coloration from current descriptions of the species. This species is recorded as occurring rather commonly in water of moderate depth from San Francisco to Puget Sound, so that this occurrence extends the known range considerably southward.

Two other species were taken which are known to occur as far south as Point Concepcion, and although not actually extending their known range appreciably, may nevertheless be listed as rare here at their extreme southern limit. They are the starry skate, *Raja stellulata*, Jordon and Gilbert, and a flounder, *Pleuronichthys decurrens*, Jordon and Gilbert. E. H.

LIFE HISTORY NOTES.

WINTER OCCURRENCE OF THE FULVOUS TREE DUCK IN THE CENTRAL SAN JOAQUIN VALLEY.

In that definite winter records are few in number, it is well to record the occurrence of the fulvous tree duck, *Dendrocygna bicolor*, in the central San Joaquin Valley during the winter of 1919-1920. As late as January 22 of this winter Mr. J. L. Kinnear, of Newman, saw a flock of five of these ducks on the Newman Club grounds; and still later, on January 31, Mr. C. C. Huber, also of Newman, killed two of these ducks on the Newman Club grounds. One of these specimens, mounted, Mr. Huber presented to Mr. Otto Feudner, of the Peters Cartridge Company, 583 Howard street, San Francisco, where it is now on display. The other mounted specimen he still retains in his possession. There were also a few fulvous tree ducks seen and some killed on the Gustine Club grounds during January.—J. E. Newsome, *Newman, California.*

THE POMFRET, NEAR FORT BRAGG.

Two specimens of the pomfret, *Brama raii*, were caught about three miles off the coast near Fort Bragg by W. G. Vossbrink, on July 23, 1919. They were taken on a salmon troll with spoon hook, 35 fathoms of line being out at an estimated angle of 30 degrees. The fishes measured 16½ inches and were bright silver in color. Authors have described this species as sooty gray, which appears to be characteristic of preserved specimens only, where the brilliant silvery pigment has been destroyed. An example in the National Museum which was taken off the coast of Washington, offers every evidence of having been like these specimens, as bright as a new dollar. A touch of the finger will often efface the metallic color.—J. O. Snyder, *Palo Alto, California.*

WHERE DO DEER SLEEP.

I have many times observed that mule deer in the Southern Sierras always bed within thick cedars or other forest trees on moonlight nights, whereas the same deer apparently sleep out in the open, as for instance in an apple orchard or among brush, during the dark of the moon. Whether this is a constant habit or one but locally developed I can not say, but it seems reasonable to believe that these various locations are chosen as a means of protection from enemies.—O. P. Brownlow, *Porterville, California.*

UNITED STATES FOREST SERVICE COOPERATION.

FIRE AND OUR FORESTS.

We have lately had a sudden, energetic flare of discussion all over California upon the ancient notions of "Piute forestry" whose deep fire-scars remain upon so many of our giant landmark pines and sequoias. It can be made to sound very plausible: "burn off the rubbish, the dead limbs and 'stubs,' the thick undergrowth and chaparral; clear the way for more forest, incidently get more grass, besides, all the tree-beetles which destroy so much standing timber." All this by light surface fires—variously applied, kept as far as possible under control, and aimed at producing a smooth forest floor.

The Forest Service is solidly opposed to every sort of "light burning" because they have seen it in practice many times,

and under all sorts of conditions; so are the foresters of all other civilized countries. This does not mean, of course, that foresters do not desire to burn "stubs" and dead trees so dangerously apt to be struck by lightning or burn the "tops" after logging wherever that can be done with safety, in the cool season.

The underlying principles of all scientific forestry, however, are these: Save the young growth as well as the mature trees; protect the soil; encourage reproduction; fill up all possible gaps in the forest cover—do not make more by surface fires—fight all fires to a finish. Furthermore, as the forester knows, the fire-weakened, fire-scarred tree becomes almost certainly the prey of forest insects. The main points in all this are reproduction and soil protection from loss of humus and from washes; these last are so important as to deserve another little talk later.

GAME IN THE CALIFORNIA NATIONAL FOREST.

It is generally conceded that the California National Forest contains a larger number of black-tailed deer than any other locality of equal size, and that the conditions on the forest for propagation and protection are unequalled in the west. Embracing as it does large areas of heavy brush which provide protection from natural enemies and almost unlimited forage during the entire year; large glade areas which remain practically snowless during the winter months, providing an abundance of winter feed when not fed too closely by domestic stock; and large areas of open timber, well stocked with succulent weeds and grasses, it can well be said to be ideal as a locality adapted to the perpetuation of this valuable game species.

The mating season for deer on this forest ranges from late September in the foothills, to November at the higher altitudes. The bucks shed their horns from January 15 to March 15, and new growth is noticed by June 1. The horns become hard about August 1, although at the higher elevations they are still found in the velvet during the latter part of August, and even up to September 10. The fawns appear from June 1 to the end of July, and in most cases are in pairs.

There are a few black and brown bear on the forest, but they can hardly be taken seriously as a game animal. In fact they are used by unscrupulous hunters as an excuse to go into the mountains with packs of hounds during the winter season, when there is no doubt that many violations of the game laws are committed. These bears are often very troublesome to sheep permittees and settlers within the forest who raise hogs, as the older ones frequently develop predatory tendencies. It is probable, also, that they are responsible for many of the kills of deer made by panthers, as they feed on the deer killed by the panther and disturb it in such a way that it is no longer palatable to the panther, who makes a new kill.

The most important game bird on the forest is the mountain quail. It is found in all parts of the forest above the brush line which surrounds the forest on three sides, and during the past two years have shown a gratifying increase. This is attributed in part to the destruction of ground squirrels and other small egg eating animals by the United States Biological Survey.

Valley quail are common at the lower elevations, and they, also are on the increase.

The principal fur-bearing animals on this forest, and the numbers caught during the present season so far as shown by the incomplete records at hand, are as follows:

Skunk	459
Fox (gray)	337
Coyote	241
Wild cat	136
Ring-tailed cat	119
Coon	74
Civit cat	25
Fisher	23
Badger	20
Panther	6
Bear	5
River otter	4

During the past two or three seasons there has been a large increase in the number of trappers. It is estimated that there are fifty trappers on the forest during the past season.

REPORTS.

CALIFORNIA FRESH FISHERY PRODUCTS, OCTOBER, NOVEMBER AND DECEMBER, 1919—Continued.

Compiled by Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Glenn	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexico
Albacore										81		674,826		304		675,211	64,210
Anchovy								23,336		283,210		188,910				495,456	
Barracuda	150							26	28,863	43,425	45,421	129,368	242	104,949		352,444	1,201,366
Bluefish									2,009	12,818						14,827	
Bocaccio								14,799	61,832	181,877						258,508	
Bonito									1,169	2,284	4,969	1,092,999	187	151,203		1,252,811	498,868
Carp				9,933	34,642		4,920	33					1,875	624		52,027	
Catfish		5,587		2,080	4,122		2,771									14,560	
Chilipepper								2,271	6,808	3,149						12,228	
Coalfish								110,384	4,164	5,907						120,455	
Cultus cod	1,477							193,268	24,062	82,821						301,628	
Dogfish			47				46	41,899	544	875		15,652		78,853		137,916	
Dolphin																	
Eels																	
Flounder	353		34	118			38	69,511	1,437	2,677	100	2,847	175			77,290	
Greenfish																	
Hake								45,375								45,375	
Halibut	1 985							9,832	407	889	61,050	224,446	418	90,154		389,181	1,160,200
Hardhead					17,523		211									17,734	
Herring	577		9,160				1,420	4,072	400					100		15,729	
Kingfish			12					1.477	2.055	14,177	300	137,572		1,129		156,722	559
Mackerel			14						2,283	127,190	5,375	651,639	1,944	31,439		819,884	39,226
Marlin																	
Mullet													485	247	4,069	4,801	1,660
Perch	2,648		7,443				155	11.948	14	5,768		43,341		60		71,377	
Pike				30	678		401									1,109	
Pompano								3,928		620		6,300		175		11,023	
Rock bass											1,855	50,954	301	9.895		63,005	649
Rock fish	1,223							202,562	84,396	144,694	7,205	305,440	1,373	120,465		867,358	1,674
Salmon	934,154	941	1,435	29,851	10,838		161,275	159		67						1,138,720	

Sanddab							74,763	12,006	373		1,722				88,858	
Sardine							1,338,693	2,618,900	31,219,905		2,894,703		734,489		38,806,090	
Sculpin											6,929	571			7,500	
Sea bass (black)										333	33,166		15,915		49,414	44,361
Sea bass (white)			14,584				17,360	23,228	6,498	3,589	230,952	21	7,184		303,425	31,852
Sea trout											1,319		15		1,334	335
Shad				3,147	173	6,388	45								9,753	
Shad (buck)						45									45	
Shad (roe)																
Sheepshead											1,412		1,036		2,448	
Skate							22,875	500			629	4			24,008	
Skipjack								1,523	541		253,975		350,523		606,562	1,450
Smelt	19,090		10,587			4,456	8,854	15,737	24,177	5,190	68,302	34,764	19,652		270,809	3,735
Sole	242						1,458,365	25,280	1,556	4,509	13,674		1,465		1,505,091	
Split tail					108	450									558	
Striped bass				38,594	6,834	47,821	4,788		75						93,112	
Stingaree																
Suckers					2,154										2,154	
Surf fish																
Swordfish																
Tomcod							5,756								5,756	
Trout (farm)																
Trout (steelhead)																
Tuna								25	24		20,326		45,746		66,121	53,784
Tuna (blue fin)											937				937	
Tuna (yellow fin)											2,161				2,161	
Turbot			532												532	
Whitebait																
White fish										1,805	6,924		3,547		11,776	70
Yellowtail											1,521,433	410	375,381		1,897,224	110,736
Miscellaneous			4	106		10	4,504	3,257	3,668	12,010	100,575	271	4,806		129,211	345
Total fish	961,899	6,528	43,852	83,859	77,672	230,407	3,670,292	2,920,893	32,169,346	153,211	8,683,433	103,041	2,149,356	4,069	51,257,258	3,214,970
Crustaceans—																
Crab (doz.)	296						21,185	1	15	3					21,500	
Ecrevisse (doz.)																
Shrimp							81,851				107				81,958	
Spiny lobster										14,372	173,894	25,940	32,431		196,637	269,434

CALIFORNIA FRESH FISHERY PRODUCTS, OCTOBER, NOVEMBER AND DECEMBER, 1919—Continued.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Glenn	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexico
Mollusks—																	
Abalones		225								155,547	19,848					175,620	
Clam (cockle)	786		1,758								460	2,908	498	18		6,428	65,905
Clam (mixed)	7,030	120	5,249													12,399	
Clam (Pismo)											59,997					59,997	
Clam (soft shell)	210	1,124	1,850				60,652	425								64,261	
Cuttle fish								1,033	81	2,639		100				3,853	
Mussels			209				1,248	390			489	1,426	463			4,225	
Oysters (shell) Eastern, No.			248,737					1,389,050								1,637,787	
Oysters (native)			17,615													17,615	
Snails																	
Squid										9,001		586				9,587	
Miscellaneous—																	
Frogs																	
Terrapin																	
Turtle																	171,060

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE YEAR 1919.

Compiled by Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Glenn, Colusa	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexican
bacore										81		11,225,857	126	2,326,961		13,553,025	77,874
ehovy			284,030					41,896		705,045		576,837		21,770		1,629,548	
rracuda	150							814	31,321	67,512	137,752	2,533,258	51,796	1,216,249		4,038,852	1,786,165
uefish									9,750	55,046						64,796	
ocaccio		80						61,863	104,680	1,153,078						1,319,651	
onito									1,169	2,306	23,714	2,534,433	1,042	341,024		2,903,688	600,353
rp		7,115		14,154	165,722	80	57,342	14,426				50	1,875	624		261,388	
tfish		38,625		17,323	71,878		36,322	708								164,856	
nilipepper								207,159	7,145	17,524						231,828	
albfish								319,666	6,926	8,208	18	132				334,950	
ltus cod	8,468	59,945						773,712	67,236	151,755		2,022				1,063,136	
gfish			355	11			885	143,564	1,239	5,177	3,605	62,416		293,031		612,683	
olphin																	
els								10								10	
ounder	11,498		1,218	1,453			2,540	368,613	27,504	4,184	3,621	14,610	490			435,731	
reenfish												2,405				2,405	
ake								122,913	9,320	948						133,181	755
alibut	19,844	106,717	808					37,784	4,576	18,584	316,864	1,465,499	60,832	492,387		2,523,895	2,335,603
ardhead					47,654		1,627									49,291	
erring	7,146		3,740,518				62,712	478,673	750					100		4,289,899	
ngfish			44					41,481	35,360	71,355	1,492	449,598	104	9,127		608,561	614
ackerel	180		14						3,518	450,717	20,294	2,037,581	15,544	126,748		2,654,596	48,086
arlin																	
ullet												270	485	356	6,428	7,539	1,660
erch	27,057		55,901				273	22,495	16,491	9,933		49,859	221	9,101		191,341	1,140
ike				519	2,840	10	3,141									6,510	
ompano			2					4,015	1,113	867		54,924	32	471		61,424	
ock bass											2,484	193,215	3,962	243,794		442,555	7,674
ock fish	13,503	1,492						1,127,029	305,439	459,426	85,447	1,148,074	4,885	568,890		3,714,185	67,649
almon	1,458,162	2,899,603	15,571	1,732,028	314,202	220,309	2,262,509	1,427,137	499,168	2,316,854		10				13,145,553	

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE YEAR 1919—Continued.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Glenn, Colusa	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexican
anddab								628,206	5,141,869	81,447,280	54	54,600,194	25	11,183,539		153,877,179	
ardine			141,700					1,362,518	67,885	2,602	1,394	7,830		1,821		709,738	
culpin												24,217	1,111	104		25,432	
ea bass (black)											5,183	67,464	1,825	54,525		126,997	58,273
ea bass (white)	124		27,904					23,045	317,432	18,934	29,563	1,836,454	2,631	103,650		2,359,737	74,277
ea trout	47											15,385	15	5,576		21,023	377
had				56,363	89,127		26,866	9,251				25				181,632	
had (buck)				144,430	14,050		289,821									448,301	
had (roe)				176,821	16,752		750,232									943,805	
heepshead												7,334	842	9,796		17,972	
kate								241,811	1,498		543	8,535	479			252,776	
kipjack									3,173	1,884		4,089,287		2,791,025		6,885,369	12,115
melt	46,933		69,666				4,761	138,095	51,641	109,759	9,597	145,693	128,262	47,523		751,870	5,110
ole	1,178	15						4,914,533	398,245	49,543	71,451	87,899		5,821		5,528,685	
plit tail					12,862		11,420									24,282	
triped bass			1,581	206,828	72,775		371,866	108,264		1,031						762,345	
tingaree			38,200					4,000						824		43,024	
uckers					5,790		43									5,833	
urf fish																	
word fish												17,900		352		18,252	
om cod								31,316								31,316	
rout (farm)																	
rout (steelhead)	17,217															17,217	
una									25	24	17	1,993,486	854	200,178		2,194,584	266,727
una (blue fin)												14,952,462		38,398		14,990,860	
una (yellow fin)												348,023		58		348,081	
urbot			1,652					463								2,115	
hitebait			403					5,512								5,915	
hite fish											1,305	18,034		7,852		27,191	70
llowtail											191	2,531,973	4,506	2,335,093		4,871,763	133,502
iscellaneous	356		4	106	599		31	45,320	6,012	8,342	54,450	423,249	2,997	13,413		554,879	15,907
Total fish	1,611,863	3,113,592	4,359,541	2,350,036	811,261	220,399	3,882,331	12,706,286	7,120,345	87,137,997	766,439	103,523,604	286,941	22,553,181	6,428	250,453,244	5,493,871

rustaceans—																		
Crab (doz.)	1,882							51,935	428	128	3					54,376		
Ecrevisse (doz.)																		
Shrimp								747,023				107				747,130		
Spiny lobster											19,465	167,680	29,852	39,897		256,894	832,571	
ollusks—																		
Abalones	450	225							740	248,056	509,732					759,203	65,905	
Clam (cockle)	786		15,857								1,020	5,768	1,328	18		24,777		
Clam (mixed)	27,699	1,688	34,605					251			2,228	273				65,744		
Clam (Pismo)									175		417,340					417,515		
Clam (soft shell)	210	8,728	27,945				265,268	425								302,576		
Cuttle fish			36					6,294	1,378	9,663	127	3,984				21,492		
Limpets													8,350			8,350		
Mussels	830		209				4,947	1,155	940	925	11,677	5,424	8,888	100		35,095		
Oysters (shell)																		
Eastern, No.			1,342,828					5,545,468								6,888,296		
Oysters (native)			91,950													91,950		
Snails												653				653		
Squid									92	3,689,299		8,406		445		3,698,242		
Miscellaneous—																		
Frogs (doz.)								328								328		
Terrapin (doz.)	2	64						84			10					160		
Turtle																	255,239	

CANNED, CURED AND MANUFACTURED FISHERY PRODUCTS OF CALIFORNIA FOR THE YEAR 1919.

Compiled by the Department of Commercial Fisheries.

CANNED.

Species of fish	Size of cans	San Diego district, cases	San Pedro district, cases	Monterey Bay district, cases	Northern California district, cases	Total cases
Abalone	1-lb.		105		2,873	2,978
Albacore	1-lb.	5,862	21,236			27,098
	½-lb.	37,855	107,822			145,677
	¼-lb.	4,152	15,325			19,477
Anchovy	½-lb.	184	32			216
Barracuda	1-lb.		8			8
Bonita	1-lb.	12	2,177			2,189
	½-lb.	4,965	34,624			39,589
	¼-lb.	287	17,108			17,395
Caviar	½-lb.		395			395
	3-oz.		374			374
Herring	1-lb. oval				28,236	28,236
	½-lb. oval				1,589	1,589
Mackerel	1-lb.	66	1,995			2,061
	½-lb.	17	6,344			6,361
	¼-lb.		988			988
Rock bass	½-lb.		10			10
Salmon	1-lb. oval			102	725	827
	1-lb. tall				1,941	1,941
	1-lb. flat				9,086	9,086
	½-lb. flat				18,667	18,667
Sardines	1-lb. oval	33,594	113,909	790,724	7,842	946,069
	1-lb. round		11,875			11,875
	1-lb. tall				7,318	7,318
	½-lb. oval	3,878	27,713	11,960		43,551
	½-lb. square	9,543	17,510	7,207		34,260
	¼-lb. round	405	25,742	128		26,275
	¼-lb. round	10	3,213			3,223
	¼-lb. square	39,603	31,553	7,789		78,945
Shad	1-lb.				4,350	4,350
Shad roe	½-lb. oval				1,131	1,131
Skipjack (striped tuna)	1-lb.	3,199	750			3,869
	½-lb.	38,229	28,849			67,078
	¼-lb.	2,460	11,351			13,811
Squid	½-lb.			3,538		3,538
Tuna	4-lb.		1,905			1,905
	1-lb.	1,170	33,524			34,694
	½-lb.	14,555	291,453			306,008
	¼-lb.	2,785	119,980			122,765
Turtle		7,407				7,407
Yellowtail	1-lb.	12	350			362
	½-lb.	19,291	8,739			28,030
	¼-lb.	5				5
Total cases canned		229,466	936,969	821,448	83,758	2,071,641

DRIED, SALTED, SMOKED AND MISCELLANEOUS.

Species of fish, size or quantity	San Diego district	San Pedro district	Monterey district	Northern California district	Total
Albacore bellies, smoked, lbs.		4,368			4,368
Anchovy, salted, lbs.		63,150	242,576	24,448	330,174
Anchovy, salted, 5-lb. cans, 24 cans to case			243		243
Anchovy, salted, 5-lb. cans, 12 cans to case			367		367
Anchovy, salted, 24-lb. cans, 6 cans to case			119		119
Anchovy, salted, 12-lb. cans, 8 cans to case			216		216
Anchovy, salted, 1½-lb. cans, 24 cans to case			200		200
Anchovy, salted, 2½-lb. cans, 12 cans to case		1,800			1,800
Barracuda, dried, lbs.	67,102				67,102
Barracuda, smoked, lbs.		2,000			2,000
Bonito, salted, lbs.		68,760			68,760
Bonito, smoked, lbs.		31,003			31,003
Cuttle fish, pickled, lbs.		3,800			3,800
Herring, smoked, lbs.				1,000	1,000
Herring, sugar cured, lbs.				1,450	1,450
Mackerel, salted, lbs.		24,842			24,842
Miscellaneous fish, dried, lbs.	51,037	46,479	15,000		112,516
Miscellaneous fish, salted, lbs.	20,000	59,079			79,079
Rollmops, 10-lb. pails				1,142	1,142
Sablefish, salted, lbs.				7,519	7,519
Sablefish, smoked, lbs.				5,400	5,400
Salachini, 100-lb. tubs			100		100
Salachini, 65-lb. tubs		740	14,370	1,362	16,472
Salachini, 45-lb. tubs			987	358	1,345
Salachini, 30-lb. tubs			4,020		4,020
Salmon, mild cured, casks*			1,044	4,153	5,197
Salmon, hard salted, casks*				30	30
Sardines, dried, lbs.			15,000		15,000
Sardines, salted, lbs.		43,982	260,500		304,482
Sardines, smoked, lbs.				2,200	2,200
Sardines, salted, 2½-lb. cans, 12 cans to case		4,000			4,000
Sardines, salted, 3-lb. cans, 24 cans to case		6,007	200		6,207
Sardines, salted, 5-lb. cans, 24 cans to case			573		573
Sardines, salted, 12-lb. cans, 8 cans to case			739		739
Sardines, salted, 24-lb. cans, 4 cans to case			450		450
Sardines, salted, 34-lb. kegs			1,600		1,600
Sea bass (black), dried, lbs.	26,830				26,830
Skipjack, smoked, lbs.		2,601			2,601
Squid, dried, lbs.			686,159		686,159
Tuna, smoked, lbs.		10,180			10,180
Yellowtail, smoked, lbs.		45,933			45,933
Fish meal, tons	1,674	5,637	3,331	481	11,153
Fish, oil, gallons	26,791	146,298	300,833	40,340	514,262
Number of plants	15	35	28	21	99
Number of employees	1,191	3,928	2,218	905	8,242
Estimated value of pack	$2,599,852	$9,694,482	$6,990,566	$2,132,843	$21,417,743
Value of plants	1,100,700	4,335,657	1,366,189	906,325	7,708,871

*Casks contain 800 pounds net.

VIOLATIONS OF FISH AND GAME LAWS.

October 1 to December 31, 1919.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without license	62	$930 00
Refusing to show license on demand	1	25 00
Making false affidavit on shipment of deer hides	1	25 00
Shipping deer meat without affidavit	3	50 00
Deer—excess limit—close season—killing or possession	22	675 00
Female deer—spike bucks—fawns—killing or possession	7	350 00
Illegal deer hides	1	
Hunting on posted grounds	1	25 00
Night shooting	30	745 00
Trapping without license—close season	4	20 00
Killing a mountain sheep	1	30 00
Protected shore birds—killing or possession	56	1,305 00
Nongame birds—killing or possession	47	916 00
Shooting ducks from power boat in motion	10	150 00
Ducks—excess limit—close season	15	425 00
Quail—close season—killing or possession	36	960 00
Pigeons—close season—killing or possession	3	85 00
Doves—close season—killing or possession	1	25 00
Grouse—close season—killing or possession	1	25 00
Mudhens—close season—killing or possession	1	25 00
Cottontail and brush rabbits—close season	9	110 00
Total game violations	312	$6,901 00
Fish.		
Angling without license	3	$30 00
Fishing for profit without license	4	110 00
Striped bass—underweight—close season	5	120 00
Halibut—underweight—offering for sale—close season	4	75 00
Salmon—excess daily limit	1	
Taking salmon with snag hooks	2	100 00
Operating salmon net in closed district	8	200 00
Trout—excess daily limit—close season	2	50 00
Catfish—undersize—offering for sale	1	20 00
Failure to maintain fish screen	1	20 00
Clams—undersized—excess limit	4	110 00
Female crabs—taking or possession	1	20 00
Abalones—red and black—under and oversized—taking or possession	12	270 00
Lobsters—under and oversized—close season—taking or possession	12	280 00
Total fish violations	58	$1,405 00
Grand total fish and game violations	370	$8,306 00

SEIZURES—FISH AND GAME AND ILLEGALLY USED FISHING APPARATUS.

October 1, 1919, to December 31, 1919.

Game.

	Pounds
Deer meat	1,074
Quail	114
Ducks	1,037
Doves	18
Pigeons	2
Rabbits	17
Avocets	4
Killdeer plover	28
Swans	5
Sandpipers	18
Miscellaneous birds	103
Deer hides	6

Searches.

Illegal fish and game	8

Fish.

	Pounds
Striped bass	6,000
Salmon	852½
Halibut	6,621½
Trout	78
Catfish	5
Sturgeon	39
Barracuda	3,995
Miscellaneous fish	33
Clams (cockle)	916
Clams (Pismo)	456
Crabs	1,627
Lobsters	4,752
Abalones	93
Illegal nets	3

STATEMENT OF EXPENDITURES YEAR 1919.

	September	October	November	December
General administration	$3,170 98	$2,551 00	$2,384 00	$2,103 63
Research, publication and education	931 38	312 58	296 24	419 05
Printing	316 13	1,630 34	111 77	178 25
Fish exhibits	483 78	6,110 55	3 25	
Game exhibits				
Tahoe camping ground	37 23	8 00		
Mountain lion bounties	220 00	520 00	390 00	370 00
Lithographing hunting licenses			300 00	
Lithographing angling licenses		315 00		1,090 00
Hunting license commissions	2,400 50	3,626 80	1,544 60	2,673 90
Angling license commissions	1,822 90	1,471 90	1,242 90	2,186 60
Market fishing license commissions	131 50			149 50
San Francisco District	8,161 99	7,752 01	7,045 73	6,684 94
Sacramento District	5,830 40	5,654 19	5,322 42	5,008 57
Los Angeles District	2,996 46	3,079 82	3,094 65	2,921 47
Launch patrol	5,993 55	1,753 47	2,280 91	1,141 75
Prosecutions (fish and game)	155 89	304 75	276 50	63 00
Crawfish inspection	100 00	100 00	100 00	100 00
Winter game feeding				
Accident and death claims	146 59	278 42	202 65	124 04
Hatchery administration	1,266 55	1,450 51	1,289 72	1,324 73
Mount Shasta Hatchery	2,977 87	1,696 39	2,965 24	2,135 71
Klamath Station	1,369 58	1,151 14	949 72	458 82
Fall Creek Hatchery	422 91	395 49	818 98	939 00
Mount Whitney Hatchery	2,077 83	1,878 63	2,577 64	1,139 97
Cottonwood Creek Station			236 50	
Cottonwood Lakes Station				
Tahoe Hatchery	164 98	334 10	156 11	40 15
Tallac Hatchery	587 66	5 00	8 00	5 00
Chico Experimental Station	63 75		29 00	
Fort Seward Hatchery	1,021 10	1,719 25	910 49	789 23
Eel River Station			96 25	
Ukiah Hatchery		92 00		
Snow Mountain Station	8 50	49 25	11 18	989 17
Brookdale Hatchery	151 33	147 35	156 02	257 74
Scott Creek Station	30 00	31 00	30 00	31 00
Feather River Hatchery				
Almanor Hatchery	7 00	5 00	5 00	5 00
Domingo Springs Hatchery	321 20	57 25	84 43	8 30
Clear Creek Hatchery	203 71	249 06	216 22	
Bear Lake Hatchery	1,119 38	1,432 54	1,229 62	410 50
North Creek Station	403 50	474 78	1,559 45	772 36
Wawona Hatchery			312 87	133 76
Yosemite Hatchery	250 25	219 01	328 29	44 25
Kaweah Hatchery	150 70	92 00	17 00	16 60
Fish transplanting and distribution	1,537 87	4,332 49	1,804 39	319 95
Screens, fishways and water pollution	649 79	698 84	583 86	603 38
Special field investigation		150 35	102 00	
Department of Commercial Fisheries	4,095 52	3,860 81	3,775 18	3,255 76
Totals	$51,409 66	$56,021 07	$44,848 78	$38,898 08

STATEMENT OF EXPENDITURES.

July 1, 1919, to December 31, 1919.

Administration:		
Commissioners	$1,220 59	
Executive officers	14,015 36	
Printing	2,270 70	
Research and publicity	2,591 03	
Accident and death claims	1,159 88	
Total administration		$21,257 56
Commercial fish culture and conservation:		
Superintendence	$6,333 89	
Inspection and patrol	15,400 37	
Research	9,298 34	
Statistics	4,885 79	
Market fishing license commissions	374 00	
Propagation and distribution of salmon	14,461 25	
Total commercial fish culture and conservation		50,756 64
Sporting fish culture and conservation:		
Superintendence	$7,543 07	
Printing	1,596 79	
Prosecutions and allowances	72 00	
Angling license commissions	8,329 20	
Special field investigations	252 35	
Fish exhibits	7,167 16	
General patrol (pro rata share)—		
San Francisco District (40 per cent)	17,757 55	
Sacramento District (40 per cent)	14,990 67	
Los Angeles District (40 per cent)	7,030 02	
Propagation and distribution of sporting fish	73,538 47	
Total sporting fish culture and conservation		138,277 28
Game conservation:		
Printing	$2,396 07	
Prosecutions and allowances	863 14	
Hunting license commissions	12,397 80	
Mountain lion hunting	2,837 13	
General patrol (pro rata share)—		
San Francisco District (60 per cent)	23,636 35	
Sacramento District (60 per cent)	22,486 01	
Los Angeles District (60 per cent)	10,545 04	
Total game conservation		78,161 54
Tahoe camping ground		2,599 11
Total expenditures		$291,052 13

Further information regarding details of expenditures will be gladly furnished upon application to the executive office of the Fish and Game Commission, San Francisco, California.

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